

2013

# ACCOMPLISHMENTS

NOAA's National Climatic Data Center

# SCIENCE, STEWARDSHIP, AND SERVICE

## THE NATIONAL CLIMATIC DATA CENTER (NCDC)

### MISSION

Steward of the Nation's Climate Information

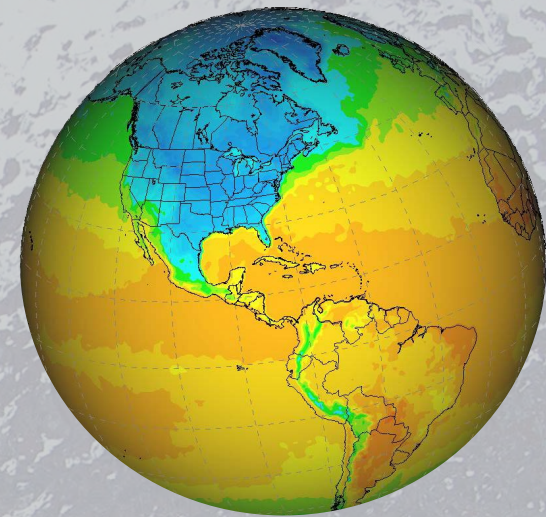
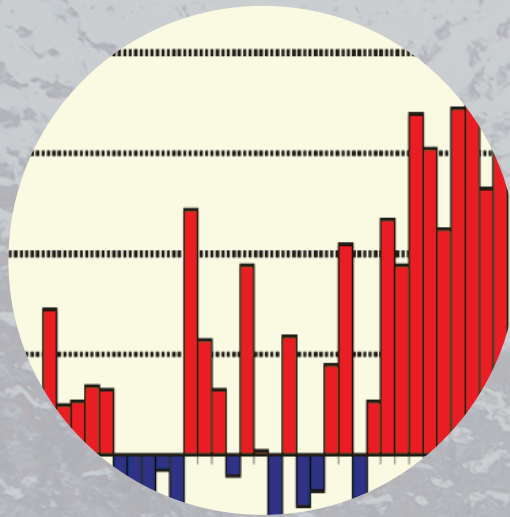
NCDC is responsible for preserving, monitoring, assessing, and providing public access to the Nation's treasure of climate and historical weather data and information.

### VISION

To be the Nation's Trusted Authority on Climate and Historical Weather Information

NCDC will be the most comprehensive, accessible, and trusted source of state-of-the-art climate and historical weather data, information, and climate monitoring.





# CONTENT

6	Explaining Extreme Events of 2012 from a Climate Perspective
7	Sustaining 16 Climate Data Records in Operations
8	Enhancing the NCDC Website and Home Page
9	Examining Differences in Sea Surface Temperature Datasets
10	Reconstructing Regional Surface Temperatures for Six Continents and the Arctic
11	Assembling the “State of the Climate in 2012” Report
11	Formalizing a Research to Operations Process for Climate Data Records
12	Transitioning a New Sea Surface Temperature Climate Data Record to Full Operations
13	Delivering the Draft National Climate Assessment for Public Review
13	Providing Users with Record-Setting Volumes of Data
14	Developing an Independent Record of Global Warming
15	Updating Hourly Climate Normals
16	Standardizing Comprehensive Large Array-Data Stewardship System Data Preservation

17	Assessing Billion-Dollar Weather and Climate Disasters
18	Improving Data Access with Climate Data Online Version 3.0
18	Creating a New Public User Interface for Station Metadata
19	Preserving U.S. Climate Reference Network Data
20	Implementing the U.S. Climate Reference Network Exception List
20	Eliminating Duplicate Geostationary Operational Environmental Satellite Data
21	Leading Production of Quarterly Regional Climate Impacts and Outlooks
21	Improving NCDC Metadata Standards
22	Monitoring Climate from Space with Architecture for Sustained Observations
23	Visualizing NCDC Data with the Weather and Climate Toolkit
24	Cultivating a New Record of Abrupt Climate Change
24	Augmenting Storage Functionality with Cloud Services
25	Engaging Users with Workshops and Forums
26	Launching the National Temperature Index Page
26	Redesigning NOAA's Climate Portal
27	Removing Duplicate Physical Records from NCDC's Archive
27	Partnering with the Cooperative Institute for Climate and Satellites—North Carolina
28	Ensuring an Operational, Effective, and Safe Work Environment
28	Evaluating and Enhancing Information Technology Operations
29	Utilizing Funds and Grants Effectively
29	Venturing into Social Media with Partners, Constituents, and the Public
30	Awards
32	Bibliography



# Message from the Director

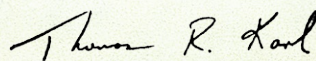
**In** 2013, NOAA's National Climatic Data Center (NCDC) again witnessed the importance of its mission to gather and preserve climate data and to provide the information to its ever-increasing breadth of customers.

The year was one of precipitation extremes across the United States, with California having its driest year on record while Alaska had its third wettest autumn and New York, South Carolina, Georgia, and Florida each had their wettest summer on record. While many of the biggest climate disasters fell outside the United States in 2013, the world continued to see warmer than normal temperatures and drastic variations in precipitation from region to region. Throughout it all, NCDC staff developed, updated, and extended the Center's products and services to capture and report the current and historical perspective of the climate-related extreme events that surfaced during the year and provided needed data to partner organizations to assist their efforts.

The following pages feature our key accomplishments throughout 2013, including sustaining 16 Climate Data Records in operational status, developing an independent record of global warming, examining differences in sea surface temperature datasets, delivering the draft Third National Climate Assessment for public review, leading the production of quarterly regional climate impacts and outlooks, and assessing and evaluating billion-dollar disasters and extreme events.

In keeping with the Center's role as the world's largest archive of climate information, NCDC achieved a new archive record of 13.4 petabytes, which is equivalent to the storage space needed to hold over 40 years of high-definition television video. Customers downloaded another record of 5.0 petabytes of NCDC-stewarded data during the 2013 fiscal year, including 3.6 petabytes of satellite data, 0.802 petabytes of model data, and 0.317 petabytes of radar data. The Center also enhanced its website and updated its popular Climate Data Online application to better meet user needs.

NCDC scientists also contributed to the understanding of climate impacts and change. The "State of the Climate 2012" report was released by the *Bulletin of the American Meteorological Society* in July 2013, and the bibliography at the end of this 2013 Accomplishments Report reveals the list of over 50 peer-reviewed papers published by major scientific media as well as conference presentations by our scientists. With our partners, NCDC also hosted a series of workshops and forums to engage climate data users and business leaders, which focused on frost and freeze data and precipitation data as well as business-related climate risks, impacts, and opportunities.

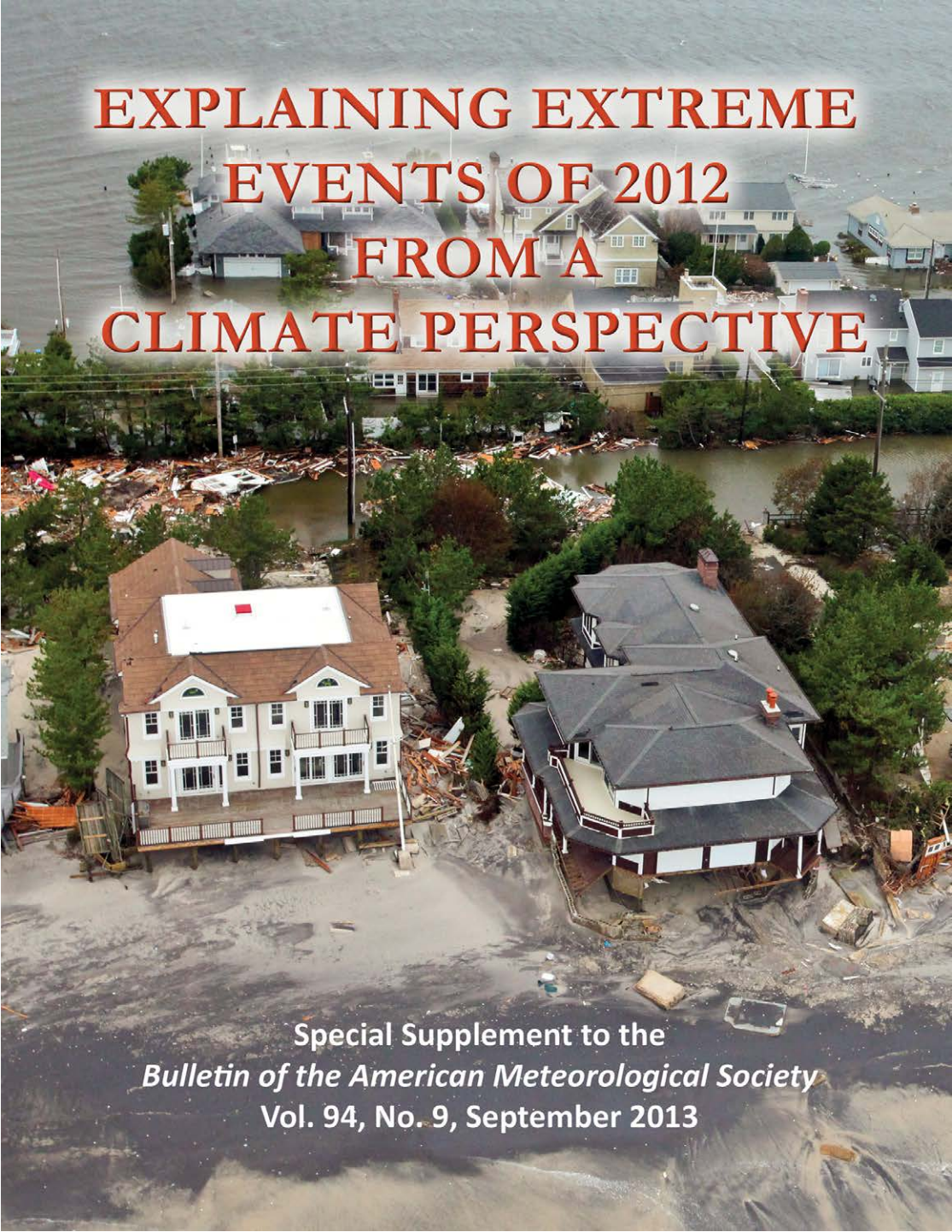


Thomas R. Karl



**T**his annual report highlights key accomplishments as we continue to carry out critical climate science, develop new and better applications to enable climate data access, and monitor our changing planet.





# EXPLAINING EXTREME EVENTS OF 2012 FROM A CLIMATE PERSPECTIVE

Special Supplement to the  
*Bulletin of the American Meteorological Society*  
Vol. 94, No. 9, September 2013

## EXPLAINING EXTREME EVENTS OF 2012 FROM A CLIMATE PERSPECTIVE

For the second year, NCDC scientists collaborated with their colleagues across the globe to examine the causes of certain extreme events. Scientists from NCDC served as part of the team of lead editors for the report, entitled “Explaining Extreme Events of 2012 from a Climate Perspective” and published as a supplement to the *Bulletin of the American Meteorological Society*. Overall, 18 different research teams from around the world contributed to the peer-reviewed report that examined the causes of 12 extreme events that occurred on five continents and in the Arctic during 2012. In addition to investigating the causes of these extreme events, the multiple analyses of four of the events allowed the scientists to compare and contrast the strengths and weaknesses of their various analytic methods. Despite the different strategies, there was considerable agreement between the assessments of the same events. By further developing the ability to put extreme weather and climate events into the longer-term context of climate change, NCDC is helping provide the public with the information needed to make decisions about effectively minimizing and preparing for the impacts of these events.

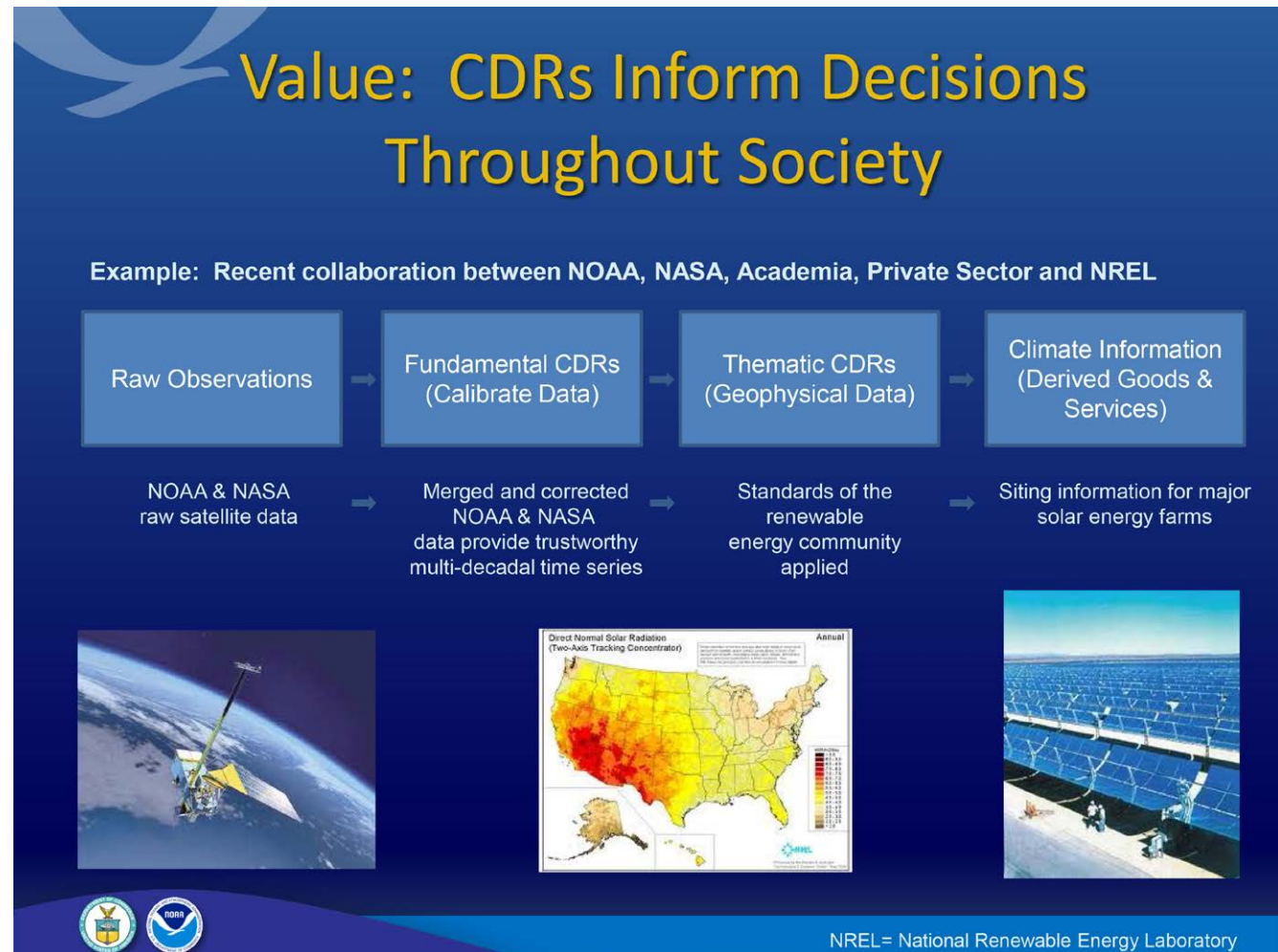


## SUSTAINING 16 CLIMATE DATA RECORDS IN OPERATIONS

In 2013, NCDC expanded its national inventory of operational Climate Data Records (CDRs) to 16 by transitioning five new CDRs from research to operations, which included the atmosphere mean layer temperatures record, microwave imager and sounder records, and a global precipitation record. The CDR Program is responsible for generating and archiving operational climate data records for the atmosphere, oceans, and land. These CDRs provide authoritative, observation-based information on how, where, and to what extent the land, oceans, atmosphere, and ice sheets are changing.

The 16 operational CDRs will provide input to emerging climate prediction modeling as well as capture and maintain the Nation's record of climate history. This includes the severity and frequency of drought, floods, and hurricanes. The CDRs are produced from decades of satellite data and used by industry, government, and research communities to detect, assess, model, and predict climate change. Decision makers value these long-term records for devising effective strategies to respond to, adapt to, and mitigate the impacts of climate variability and change.

In order to produce CDRs, NCDC developed long-term, seamless homogeneous records characterizing climate change and variation. As new climate algorithms and sensor knowledge are developed, NCDC reprocesses the entire period of record to update the data. Further, NCDC is establishing practical approaches to information preservation, long-duration software, and algorithm maintenance. These approaches leverage the application of software engineering expertise and tailoring of existing standards and best practices. NCDC also devised new requirements to ensure that CDR software design and documentation can accommodate migration to future computing platforms and software languages.





# NOAA

NATIONAL CLIMATIC DATA CENTER  
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION



[Home](#) [Climate Information](#) [Data Access](#) [Customer Support](#) [About NCDC](#)

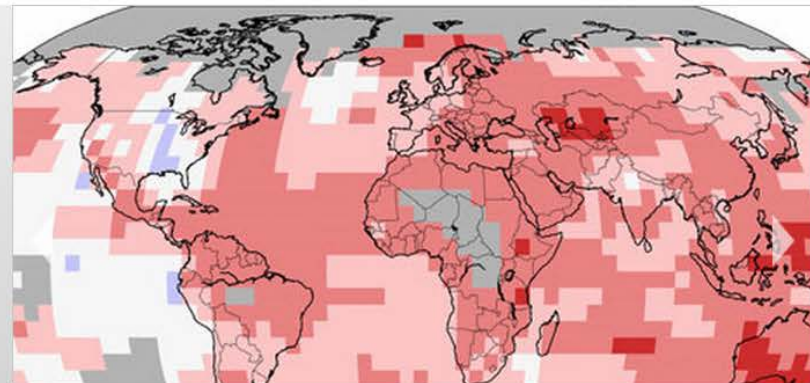
Search NCDC



NOAA's National Climatic Data Center (NCDC) is responsible for preserving, monitoring, assessing, and providing public access to the Nation's treasure of climate and historical weather data and information. [Learn more about NCDC »](#)

#### How may we assist you?

- [I want to search for data at a particular location.](#)
- [I want quick access to your products.](#)
- [I want to see your monthly climate reports.](#)
- [I want to find a specific dataset.](#)
- [I want to know about climate change and variability.](#)



#### NCDC Releases 2013 Global Climate Report

The globally averaged temperature for 2013 tied as fourth warmest year since record keeping began in 1880.

1 2 3 4 5

## ENHANCING THE NCDC WEBSITE AND HOME PAGE

In May 2013, NCDC enhanced its website and redesigned its home page. This resulted in simplified access to systems, data, and services; more efficient maintenance; and the introduction of Google Analytics to better analyze website traffic and anticipate customer needs. This enhanced redesign features better navigation for major topical areas, including data access and climate information, and streamlines content and data access systems into logical groupings. Global customers are now able to easily gather pertinent data and information for their needs and operations. NCDC will continue to see future benefits from this redesign, which also simplifies hardware and software support, enhances security, and allows for better use of personnel resources by streamlining maintenance.

#### NCDC Partners



**Climate.gov**  
science & information for a climate-smart nation



**weather.gov**  
THE NATIONAL WEATHER SERVICE



**drought.gov**  
U.S. Drought Portal



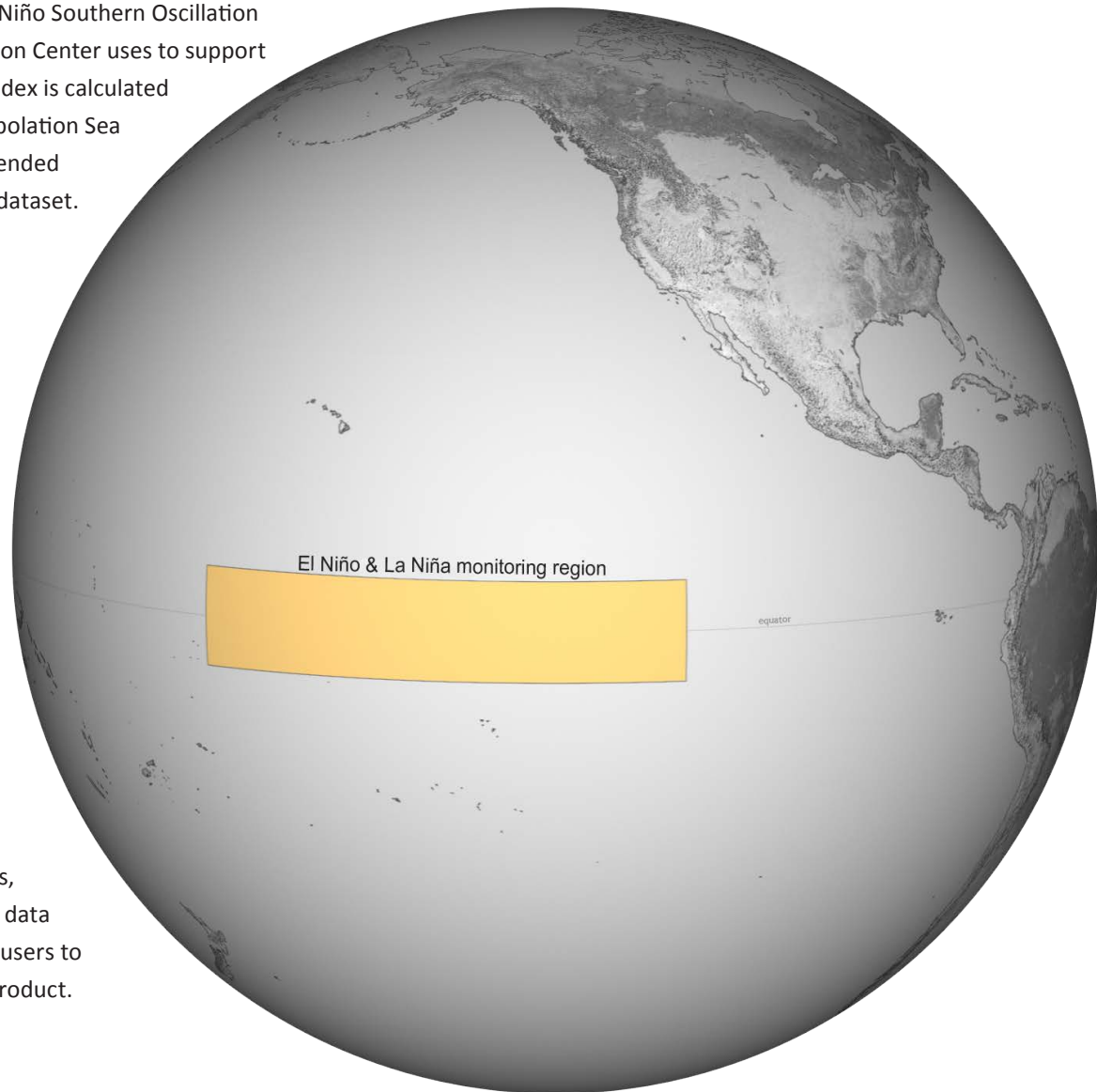
**globalchange.gov**  
U.S. Global Change Research Program



## EXAMINING DIFFERENCES IN SEA SURFACE TEMPERATURE DATASETS

The Niño 3.4 index is an important measure of El Niño Southern Oscillation (ENSO) conditions, which NOAA's Climate Prediction Center uses to support ENSO monitoring and forecasting. The Niño 3.4 index is calculated based on two NCDC datasets: the Optimum Interpolation Sea Surface Temperature (OISST) dataset and the Extended Reconstructed Sea Surface Temperature (ERSST) dataset. In 2013, scientists found that monthly Niño 3.4 indices calculated from the two datasets differed by as much as 0.5°C in some ENSO events. Such large differences complicate the monitoring and prediction of current and future ENSO conditions, so NCDC scientists analyzed the datasets and computational methods of the index to identify the causes of the differences.

NCDC completed several experiments on the data involving the integration of satellite observations into ERSST and the analysis of bias adjustment methodologies in both OISST and ERSST. These analyses found that the major cause of the difference was the bias adjustment applied to the satellite sea surface temperature measurements used to produce the OISST dataset. By accounting for these differences, NCDC not only verified the quality of the Center's data analyses, but also provided an objective basis for users to select the appropriate sea surface temperature product.



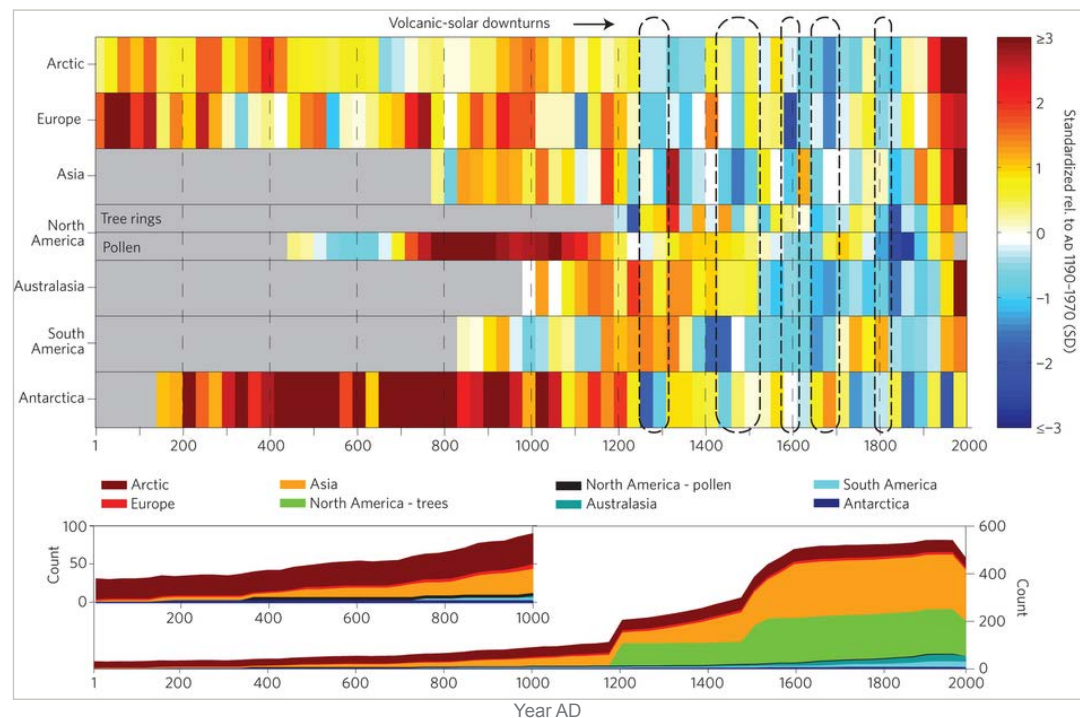
NOAA Climate.gov

For real-time La Niña/El Niño tracking, NOAA watches for temperature anomalies in the central tropical Pacific (between 5° north and south latitude and 120° to 170° west longitude). Map by Climate.gov team, adapted from original by the NOAA Climate Prediction Center.

## RECONSTRUCTING REGIONAL SURFACE TEMPERATURES FOR SIX CONTINENTS AND THE ARCTIC

NCDC scientists helped construct a one-of-a-kind synthesis and analysis of temperatures over the last 2,000 years for six different continents and the Arctic. This effort is part of a large international effort under the auspices of the Past Global Changes Programme of the International Geosphere–Biosphere Programme. These reconstructions cover the last millennium on annual-to-decadal timescales and extend into the first millennium of the Common Era, which began in 1 AD, on annual-to-multidecadal timescales. To date, scientists have produced 2,000 year-long annual-to-decadal temperature time series for the hemispheres and the globe, but not at the continental scale.

For this project, NCDC scientists served as group leaders for the North American regional reconstruction and as part of the core writing team for the highly cited paper, “Continental-scale temperature variability during the last two millennia” in *Nature Geoscience*. The Center also served as the data hub for the entire effort, producing state-of-the-art proxy and reconstruction datasets for the Common Era. Overall, this effort greatly extended the record of past climate and explicitly characterized uncertainties in the reconstructions. With these data, scientists will be able to better understand extremes in annual to decadal temperature fluctuations over the past 2,000 years in a way that is not possible using the instrumental record alone.



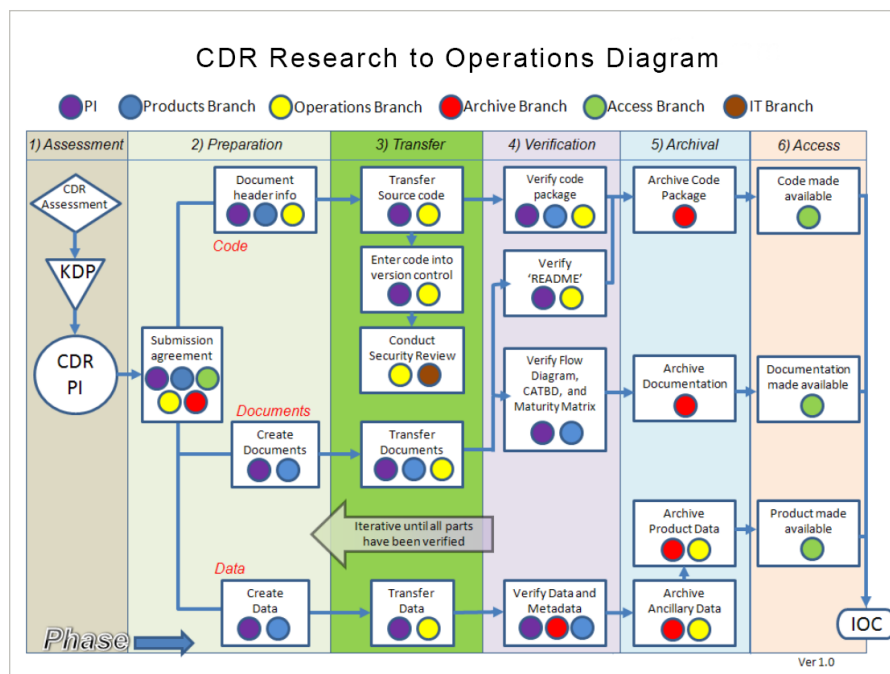
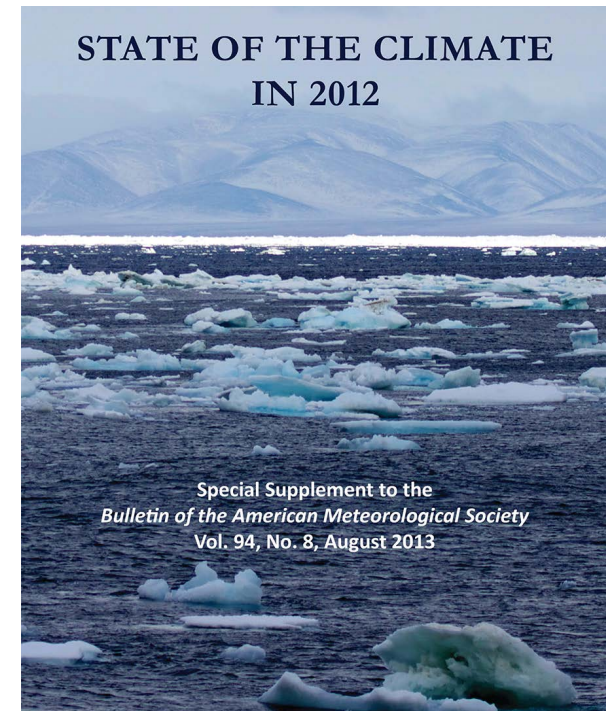
Continental-scale temperature reconstructions



## ASSEMBLING THE “STATE OF THE CLIMATE IN 2012” REPORT

The “State of the Climate” series has provided a detailed update on global climate indicators, notable weather events, and other data collect by environmental monitoring stations and instruments since the report’s inception in 1990. For the 13th consecutive year, NCDC scientists served as lead editors of the report, which was compiled by 384 scientists from 52 countries across the globe and published as a supplement to the *Bulletin of the American Meteorological Society*. For the second year, the report was accompanied by an online rollout at Climate.gov, providing easy access to key themes of the report for the public.

The report used dozens of internationally recognized climate indicators to track and identify changes to and overall trends in the global climate system. Each indicator includes thousands of measurements from multiple independent datasets. The diverse array of international authors helped consolidate this wide range of data, using their expertise to more fully understand and communicate the state of the complex climate system. Overall, the report provides a valuable reference for the increasing number of professionals and consultants who consider climate conditions and trends in their work.



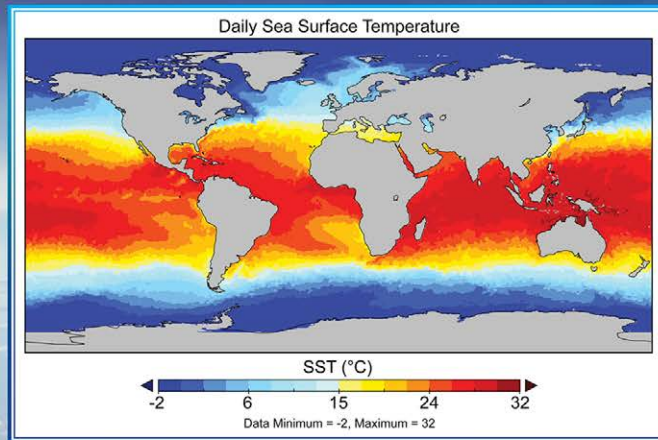
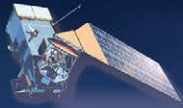
## FORMALIZING A RESEARCH TO OPERATIONS PROCESS FOR CLIMATE DATA RECORDS

The Climate Data Record (CDR) Program’s mission is to affordably provide authoritative CDRs that allow the Nation to successfully adapt to a changing environment. To further this mission, NCDC implemented effective operation and management procedures and data stewardship. The Center formalized an improved transition to operations process for CDRs by adding an operational readiness review, which serves as a final check to ensure each new dataset is both transparent and scientifically defensible before being released to the public. These new and improved operation procedures and processes along with the stewardship activities performed for the existing operational CDRs allow better management and effective operation of the data generation and maintenance, providing better data service to users.

# NOAA's Climate Data Record (CDR) Program

## OPTIMUM INTERPOLATED SEA SURFACE TEMPERATURE

# OISST



### OISST CLIMATE DATA RECORD SPECIFICATIONS

- Global Product
- 0.25 Degree Resolution
- Daily Product
- 1981–Present
- Updated Daily

### INPUTS TO THE OISST CLIMATE DATA RECORD

- Buoy Data
- Ship Data
- Advanced Very High Resolution Radiometer (AVHRR) Satellite Data
- Sea Ice Data

### SOME USES OF THE OISST CLIMATE DATA RECORD

- Predicting El Niño and La Niña Events
- Forecasting Typhoon Intensity and Monsoon Rainfall
- Predicting Fishery Yields
- Studying Coral Reef Bleaching

### OISST CLIMATE DATA RECORD

<http://www.ncdc.noaa.gov/cdr/operationalcdrs.html>

### CLIMATE DATA RECORD PROGRAM INFORMATION

<http://www.ncdc.noaa.gov/cdr/index.html>

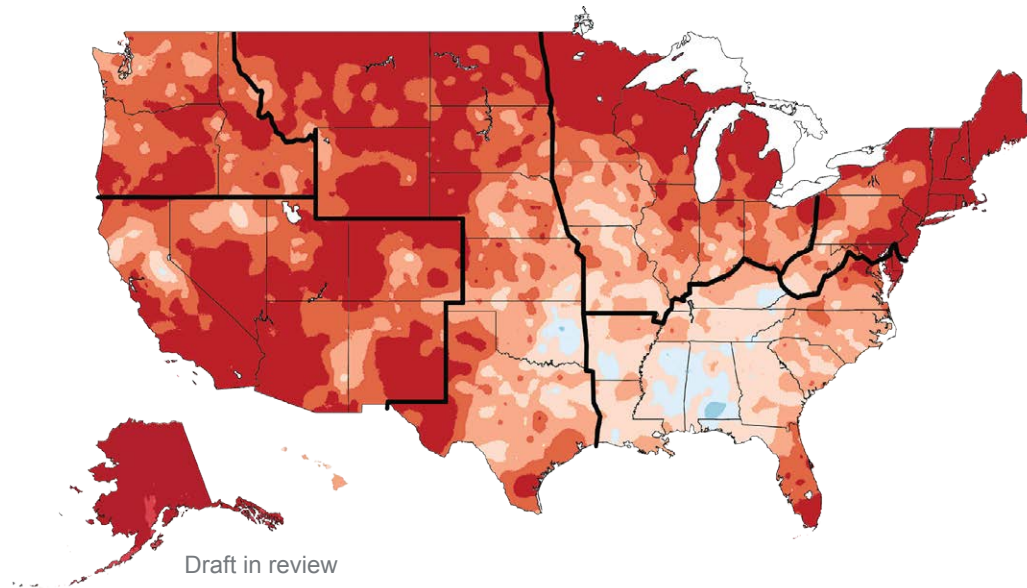
## TRANSITION A SEA SURFACE TEMPERATURE CLIMATE DATA RECORD TO FULL OPERATIONAL CAPABILITY

In 2013, NCDC completed a major rejuvenation of the Optimum Interpolation Sea Surface Temperature (OISST) Climate Data Record (CDR) software, reducing code complexity and ensuring long-term maintainability. This software transformation begins the process of transitioning the OISST CDR into full operational capability, which is expected to be complete in 2014. In support of its transition, NCDC also began developing a process to bring all OISST supporting software into compliance with coding and documentation standards.

The OISST CDR consists of a high-resolution sea surface temperature analysis product produced daily on a quarter-degree grid using satellite data along with surface-based data from ships and buoys. The OISST analysis method combines the advantages of both surface-based data and satellite data to yield the high-resolution product, ensuring a consistent dataset.







## DELIVERING THE DRAFT NATIONAL CLIMATE ASSESSMENT FOR PUBLIC REVIEW

The Global Change Research Act of 1990 requires the Federal Government to produce an assessment of climate change and impacts in the United States every four years. In their effort to fulfill this requirement, the Technical Support Unit housed at NCDC is supporting scientific, editorial, graphical, and web activities for the Third National Climate Assessment, scheduled for public release in 2014. Together with NCDC's Graphics Team, the Technical Support Unit assembled a draft of the Assessment

and released it for public review in 2013. More than 4,000 comments were received by the end of the review period, and each of them was considered and responded to with appropriate edits in the report. The Third National Climate Assessment will provide the public with current information on climate change, its impacts, and response options for the United States.

## PROVIDING USERS WITH RECORD-SETTING VOLUMES OF DATA

NCDC receives and archives data to preserve them for posterity from every corner of the globe, including land-based, marine, model, radar, weather balloon, satellite, and paleoclimate data. NCDC routinely incorporates, stewards, and provides access to these data to meet the needs of a wide variety of customers. In 2013, NCDC planned for vast increases in data requests and implemented information technology infrastructure to proficiently handle increases in data delivery. NCDC also upgraded its system, which retrieves data from the digital archives, to improve efficiency and reduce data delivery times for radar and satellite orders.

Throughout the 2013 fiscal year, users from all over the world downloaded NCDC's model, satellite, and radar data—totaling a record volume of 5.0 petabytes. In contrast, one petabyte of data is equivalent to the digital space needed for over 13 years of high-definition television. Satellite data access had the highest volume of data downloaded with 3,600 terabytes, followed by model (802 terabytes) and radar (317 terabytes) data.



## DEVELOPING AN INDEPENDENT RECORD OF GLOBAL WARMING

In collaboration with researchers from the University of South Carolina, the University of Colorado, and the University of Bern in Switzerland, NCDC developed a compilation of temperature records based on data from ice cores, corals, and lake sediment layers that revealed a pattern of global warming from 1880 to 1995 comparable to the global warming trend recorded by thermometers. While the thermometer-based global surface temperature record provides meaningful evidence of global warming over the past century, it is critical to have independent analyses to verify that record because it can be affected by

such things as land-use changes, shifts in station locations, and variations in instrumentation. For this analysis, the team used environmentally sensitive proxies to compile a temperature record spanning 130 years that is independent from thermometer-based records. The research, which was detailed in “Global Warming in an Independent Record of the Past 130 Years” published in *Geophysical Research Letters*, resolved some of the uncertainty associated with thermometer records.

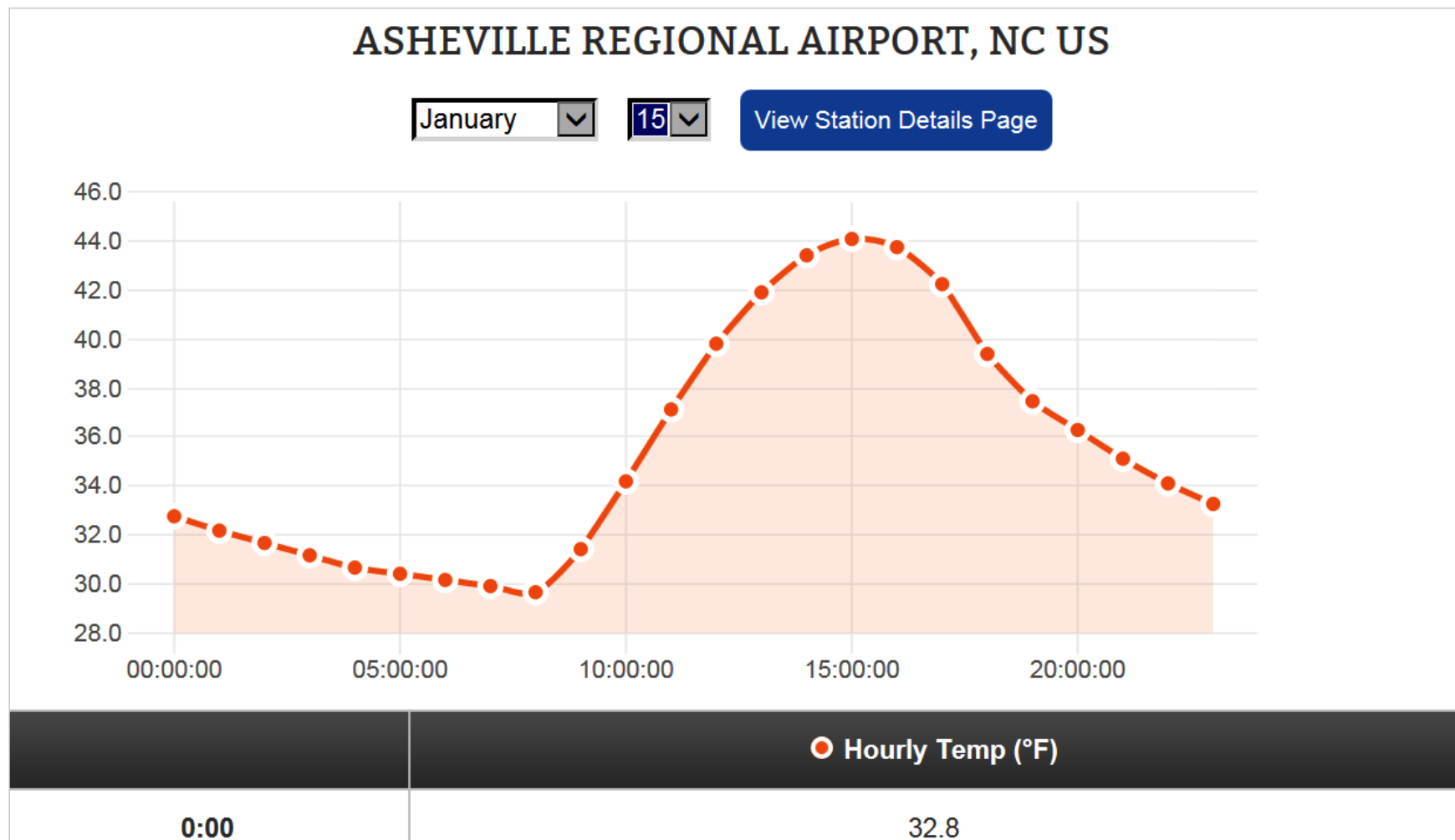


Carlsbad Caverns, captured by photographer Ansel Adams. Scientists can extract temperature records from the chemistry of layers in stalagmites and stalactites, corals, layered ocean sediments, ice cores, and other paleo proxy records. A new compilation of these paleo “proxies” reveals a pattern of global warming in the last 130 years that’s similar to the thermometer record. Credit: Department of the Interior National Park Service

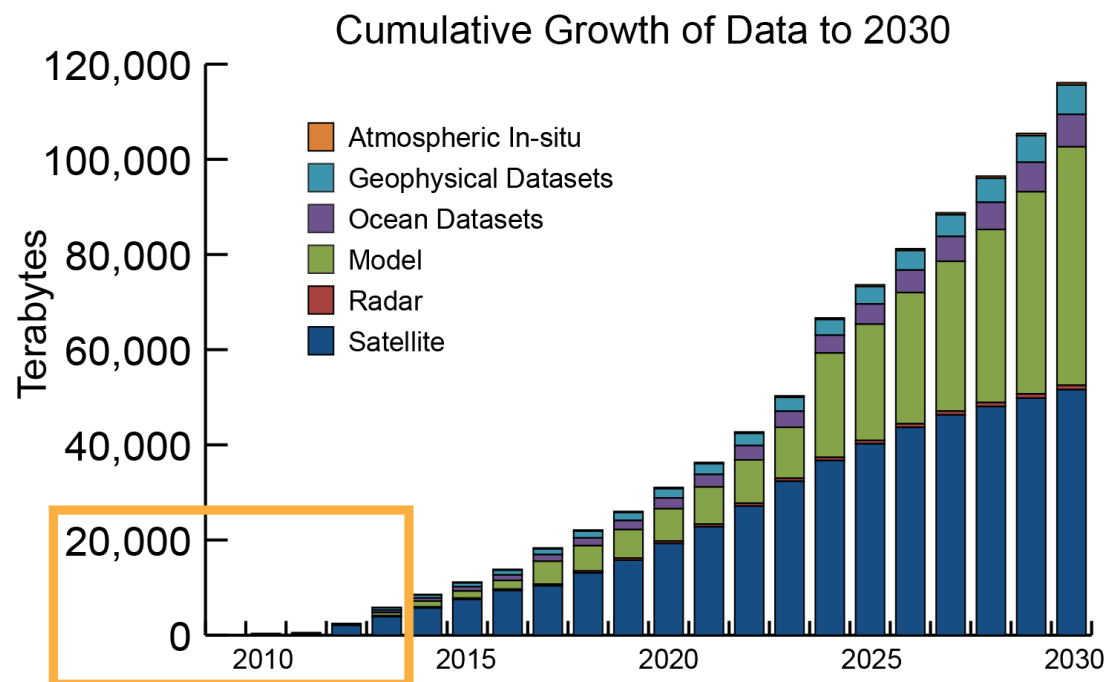
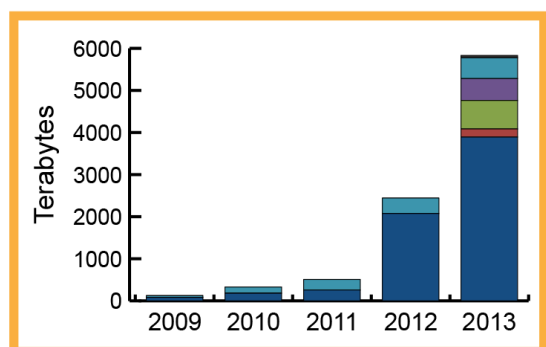


## UPDATING HOURLY CLIMATE NORMALS

In response to user needs and feedback, NCDC updated and expanded the hourly Climate Normals dataset, which includes averages of climatological variables such as temperature, dew point, cloud coverage, various wind statistics, wind chill, and heat index. The standard 30-year hourly Climate Normals dataset was expanded to include nearly 200 stations and updated for the 1981–2010 period. NCDC also created a new record of 10-year hourly Climate Normals, and the introduction of Automated Surface Observing System data in the 1990s allowed this record to include over 800 stations with even greater spatial coverage than the 30-year Normals. These use-inspired products will enable decision makers to be better informed and will allow researchers to compare 30-year and 10-year Normals to gain perspective on how the climate may have changed at certain locations.



## CLASS Archive Cumulative Total Volume by Data Type (Terabyte)



## STANDARDIZING COMPREHENSIVE LARGE ARRAY-DATA STEWARDSHIP SYSTEM DATA PRESERVATION

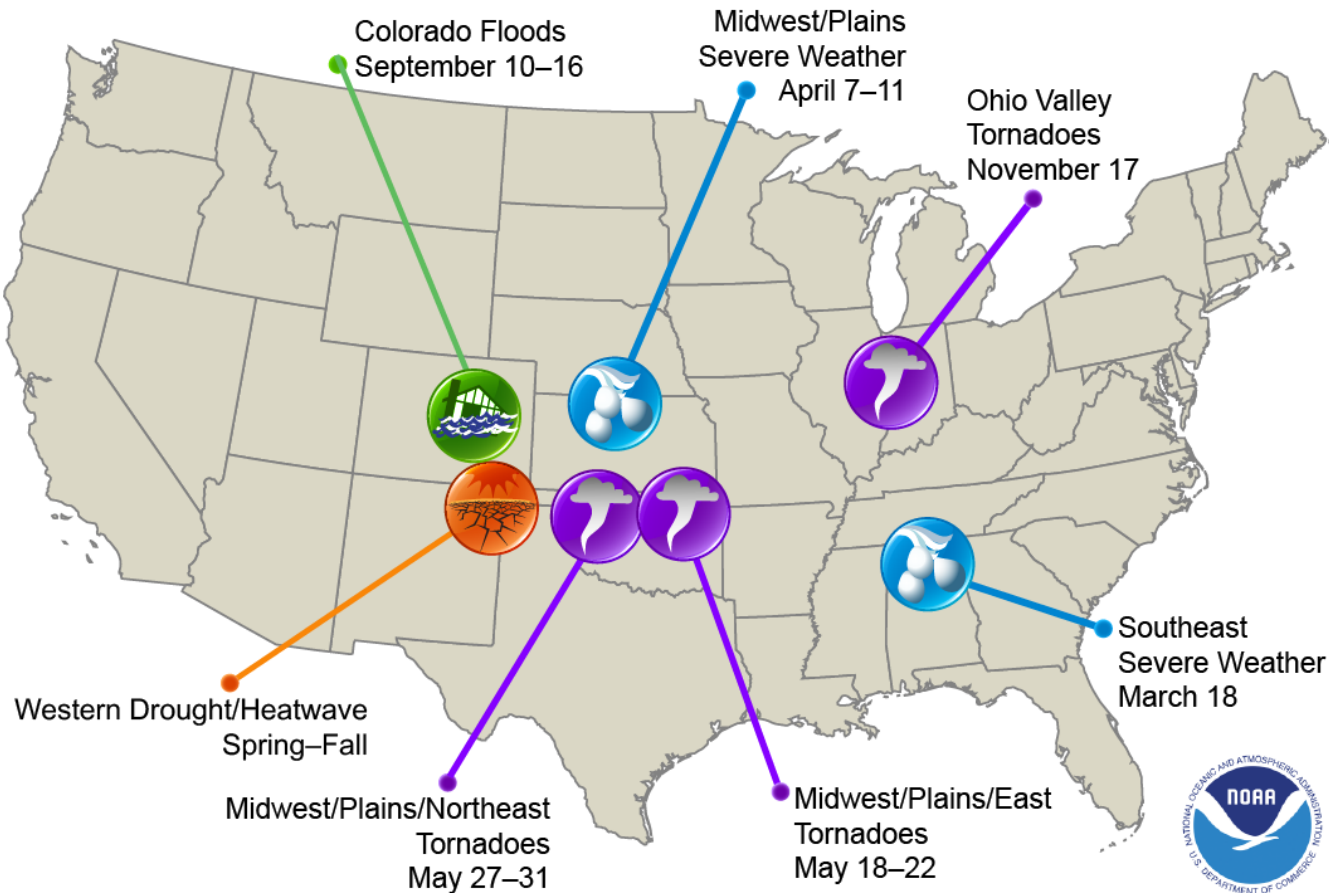
The Comprehensive Large Array-Data Stewardship System (CLASS) was originally designed to ingest, archive, access, and disseminate raw and derived data products from large satellite programs. In expanding CLASS to be an enterprise solution for long-term preservation of environmental datasets, not only for large satellite campaigns but also for smaller ground-based datasets, NCDC collaborated with its sister NOAA data centers to develop a common simple interface for ingesting data into CLASS for archival storage. This new approach fundamentally changed both the cost and functional models of the data centers' use of CLASS by including common submission to standardize all data within the system. The new interfaces will also lower cost of operations for both ingesting data and providing access to CLASS data holdings. The standardization of CLASS interfaces to data will allow the data centers to develop new and innovative search and discovery tools that will easily and cost-effectively conform to the standardized interfaces. This will help ensure ease of access to CLASS data for the public.



## ASSESSING BILLION-DOLLAR WEATHER AND CLIMATE DISASTERS

NCDC tracks and evaluates significant weather and climate events in the United States that have major economic and societal impacts. Details of these events are published semiannually in the high-profile U.S. Billion-Dollar Weather and Climate Disasters report, which is widely referenced by other federal agencies, policy makers, the media, and a variety of national assessments and reports. In 2013, NCDC updated the report to reflect 2012 statistics and collaborated with a team of consulting economists to examine the report's cost assessment methodology and data sources, devising best practices for future analyses. This report provides historical context for extreme weather and climate events in the United States that have caused damages greater than \$1 billion in total direct losses. Tracking the distribution of such events helps the public and policymakers better understand high-risk areas for various types of hazards, including floods, droughts and heat waves, tropical cyclones, severe local storms, wildfires, crop freeze events, and winter storms.

### U.S. 2013 Billion-dollar Weather and Climate Disasters



## IMPROVING DATA ACCESS WITH CLIMATE DATA ONLINE VERSION 3.0

In July 2013, NCDC released a new version of its Climate Data Online (CDO) system. The major system upgrade to CDO version 3.0 expands access to new datasets while providing a completely new look and feel. The CDO interface now includes 11 datasets, each with multiple output products, in addition to supporting access to 14 legacy systems. Users can access all of these datasets and Climate Data Record products through the CDO interactive mapping tool. For the first time, access to Level II and III NEXRAD data is available through CDO, allowing multiple radar products to be ordered in a single request.

The CDO text-based Search Tool now provides more visual feedback for any given request, displaying an interactive map that users can modify for specific data and areas of interest. The Search Tool also now includes 2,400 major cities and metropolitan areas worldwide, which were added to hundreds of thousands of geographic locations, such as towns and rivers, previously available. The Station Details page provides additional station and equipment history using NCDC's metadata system, the Historical Observing Metadata Repository. All of these updates provide a richer user experience and pave the way for enhanced access to NCDC's data holdings.



## CREATING A NEW PUBLIC USER INTERFACE FOR STATION METADATA

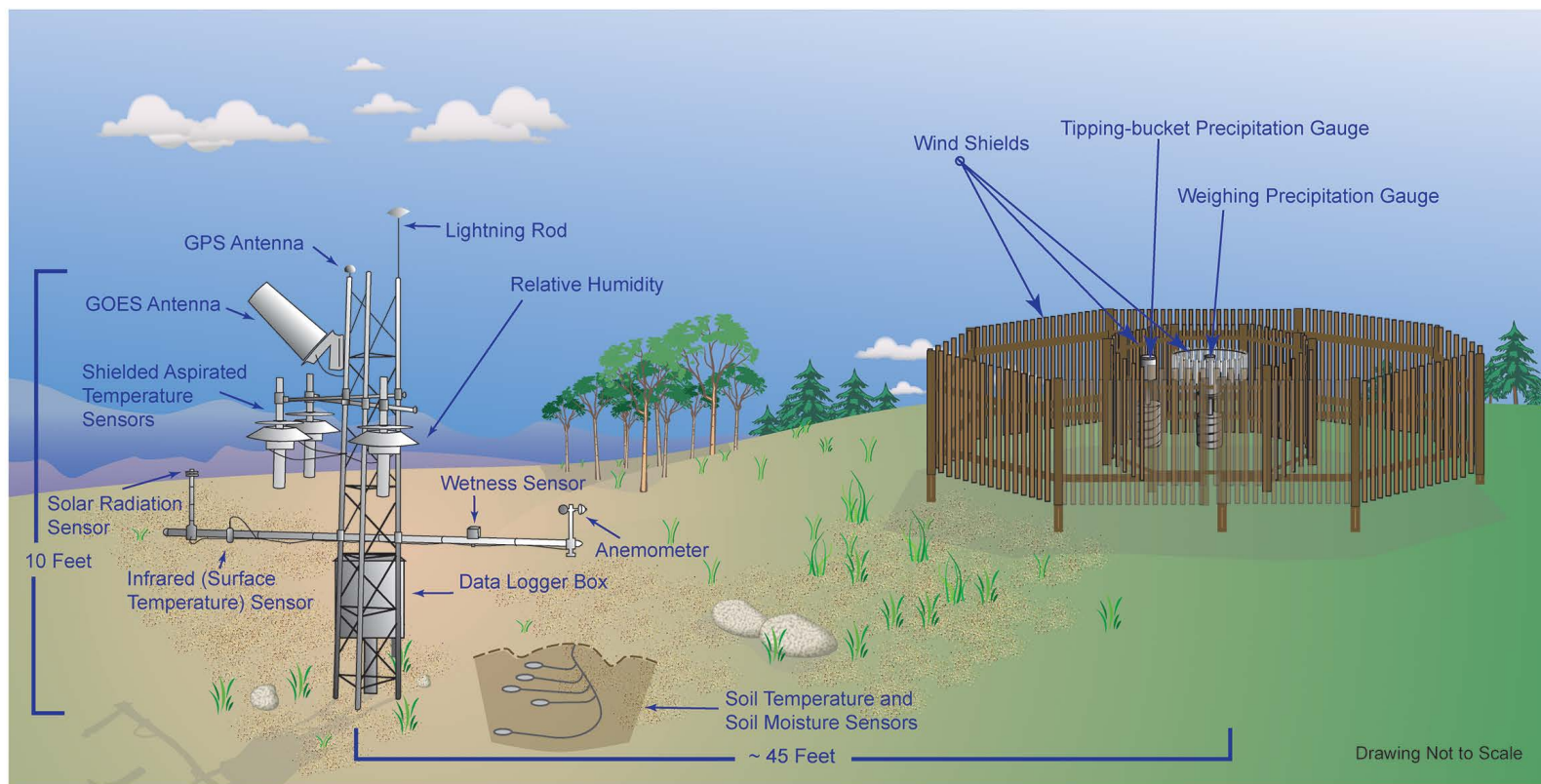
To provide a better customer experience, NCDC redesigned its database and modernized its public user interface for accessing *in situ* or land-based station metadata. The updated metadata database allows for simpler tracking of stations, easier integration of new networks, and improved graphical historical displays of station details. The new user interface allows customers to utilize an advanced station search tool to access all of the stations in the repository. The visualization system, by which users access the metadata repository, provides a graphical history of the location-based station details for each station in the Center's holdings.



The new interface provides an accurate, configurable, and simplified historical view of all the station metadata details tracked by NCDC and requires no login, unlike the previous system. By means of this

web service, users can download large quantities of station details for a variety of projects. Only two months after its initial inception in 2013, the new user interface had already surpassed the amount of web traffic seen by the old system by nearly 40%.





Typical USCRN Station configuration

## PRESERVING U.S. CLIMATE REFERENCE NETWORK DATA

The U.S. Climate Reference Network (USCRN) is a sophisticated climate-observing network of 114 stations across the contiguous United States, which NCDC specifically designed and deployed in 2002 for quantifying climate change on a national scale. As stewards of USCRN climate data, NCDC has a duty to preserve all data collected, processed, and released to the public from the network. To that end, NCDC completed a submission agreement and development of new processes for preservation of these data in the Center's archive, including data logger records, ingested data, FTP product files, and documentation. Through this effort, each version of USCRN data is now permanently preserved and readily accessible.

By ensuring the permanent preservation of these data, NCDC is furthering its mission to sustain observations that provide the capacity to assess climate variability and change. NCDC is committed to stewardship, ensuring that all data and derived products are archived with complete background information. This effort also incorporates best practices to ensure scientific quality, integrity, and the long-term utility of climate data while ensuring all USCRN data meet standards for traceability, lineage, and provenance.

## IMPLEMENTING THE U.S. CLIMATE REFERENCE NETWORK EXCEPTIONAL CIRCUMSTANCES LIST

While the U.S. Climate Reference Network (USCRN) is a sophisticated climate-observing network, exceptional circumstances can sometimes occur that cause recorded data values at a station to be unrepresentative of actual weather and climate conditions. Events such as brush fires or controlled burns near a station, for example, can increase air temperatures. And, if an instrument begins to fail, it may still report values within the range of limits for error detection.

To ensure that users are aware of data values that may have resulted from such circumstances, NCDC designed and implemented an exception list process to flag these values with a special indicator. The exception list process involves multiple points of review by scientists, developers, and boards, and NCDC established a new software system to implement the process workflow. Additionally, NCDC developed exception and resolution software suites as part of the data ingest application to ensure variables, values, or flags can be replaced as needed.

This new process also adds to the transparency of the USCRN quality assurance process. Any value that is flagged or corrected is linked to a descriptive ticket, which provides details on the issue and how it was resolved. Users of USCRN data are now easily able to determine when values have been adversely affected and should not be used. Overall, the exception list process enhances the existing USCRN data ingest software suite, while maintaining best practices for future software development.

## ELIMINATING DUPLICATE GEOSTATIONARY OPERATIONAL ENVIRONMENTAL SATELLITE DATA

To consolidate data holdings between the Comprehensive Large Array-Data Stewardship System (CLASS) and NCDC storage hardware, the Center verified common Geostationary Operational Environmental Satellite (GOES) data products on the two systems and removed over 300 terabytes of duplicate



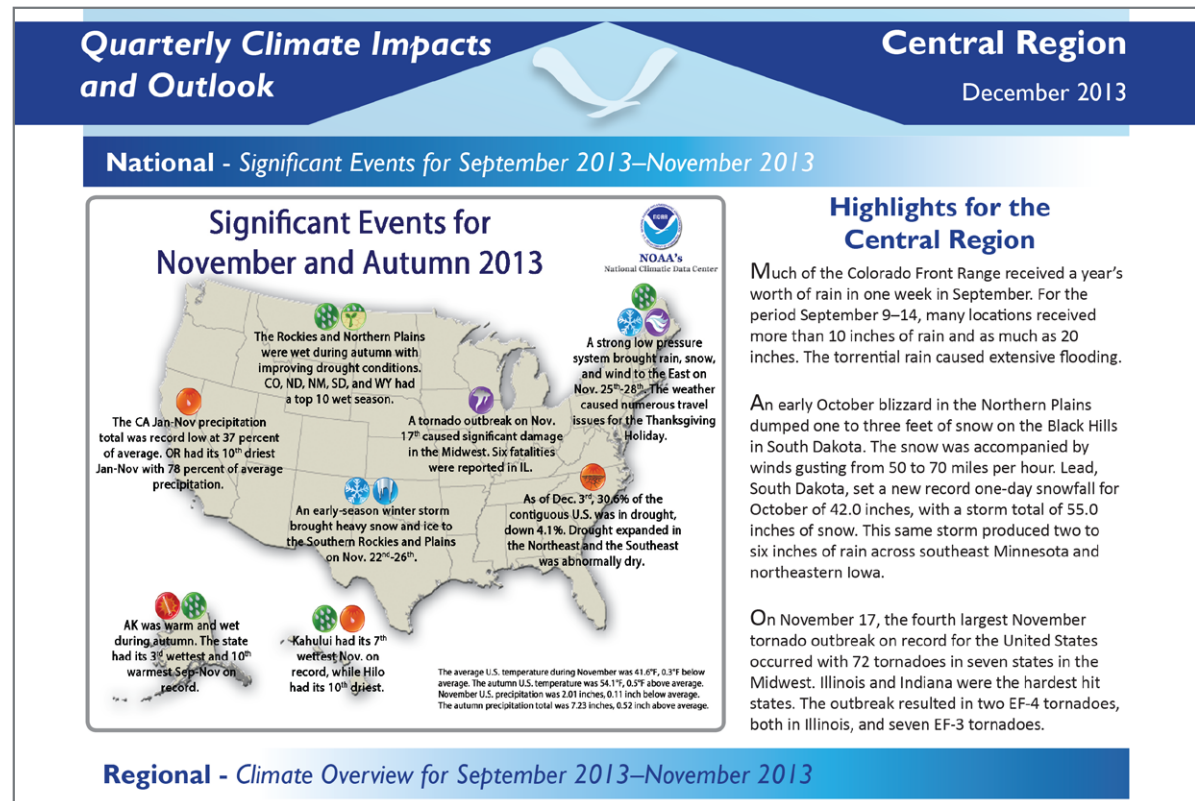
Lockheed Martin's rendition of the nation's next-generation geostationary weather satellite system, the Geostationary Operational Environmental Satellite R-Series (GOES-R)

data from NCDC hardware that now reside exclusively in CLASS. Prior to this consolidation, NCDC stored GOES data as a package of two files while CLASS stored the two files separately. To reconcile the data holdings, NCDC retrieved all files from the Center's storage system and verified each individual file against those in the CLASS inventory. Only four of the 3.4 million files examined needed to be delivered, ingested, archived, and verified in CLASS.

Once all files were verified in CLASS, NCDC removed the duplicate files from the Center's tape robotics storage system. As all GOES products were stored on a specific group of tapes, the 500 tapes, valued at \$60,000, will now be available for reuse. Consolidation of all historical GOES data will also further assist with cost reduction by eliminating storage and management of multiple copies of the 3.4 million files in multiple systems, thereby saving more than the cost of tapes over the data life cycle. Additionally, users will now have a single point of access in CLASS for all GOES data products and metadata information.

## LEADING PRODUCTION OF QUARTERLY REGIONAL CLIMATE IMPACTS AND OUTLOOKS

NOAA's Regional Climate Services program leads the production of quarterly syntheses of climate impacts and outlooks for many regions of the United States and in partnership with Canada and Mexico. These syntheses highlight recent and current climate issues at regional scales alongside NOAA data and services supporting regional customers. This effort began in 2012 and now includes at least 10 unique regional prototypes, all produced collaboratively with partner organizations.



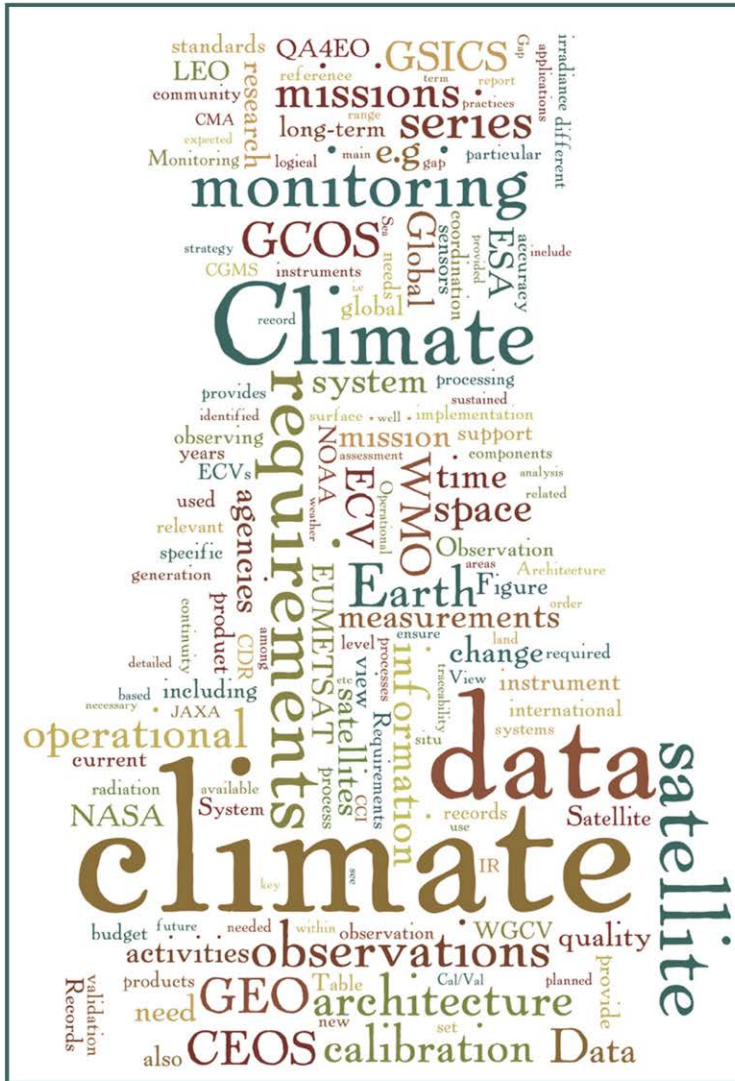
## IMPROVING NCDC METADATA STANDARDS

Metadata, which is the information about the data, is vital to understanding the data as well as for all aspects of their preservation. It essentially represents the who, what, when, where, why, and how of the data. To ensure consistency in the way metadata are collected and formatted, NCDC implemented NOAA's 2012 Environmental Data Management Committee Procedural Directive on Data Documentation for all the data collections across the Center, which provides a flexible and extensible implementation of standards.

To achieve this implementation, NCDC coordinated with the National Geophysical Data Center, National Oceanographic Data Center, National Aeronautics and Space Administration (NASA), and other partners to determine metadata usage and requirements, including implementation strategies already in operational use across the Center. Further coordination within NOAA to create a NOAA standard implementation is also currently underway. Consistent metadata implementation across NOAA, coordinated with NASA partners, will ensure increased data discovery for all collections and provide the public with an enhanced user experience.



# Strategy Towards an Architecture for Climate Monitoring from Space



# MONITORING CLIMATE FROM SPACE WITH ARCHITECTURE FOR SUSTAINED OBSERVATIONS

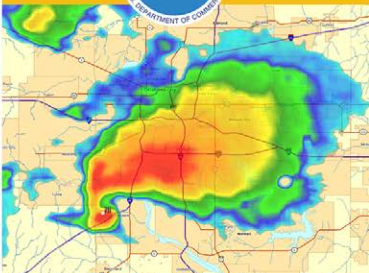
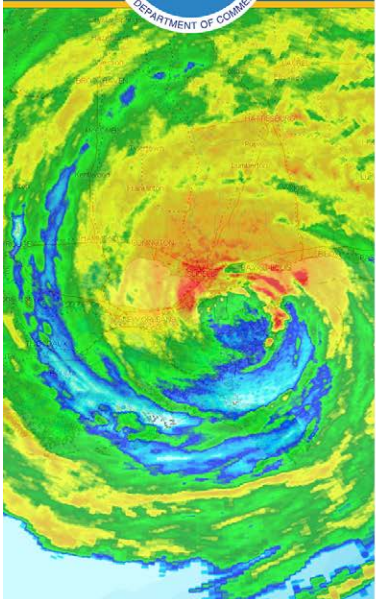

NCDC collaborated with a team of international authors to compose the report entitled “Strategy Towards an Architecture for Climate Monitoring from Space.” The report aims to help build an international architecture that ensures delivery of satellite observations in timeframes required for climate analysis. It outlines a high-level, conceptual, and inclusive strategy for implementing such architecture, ensuring that a broad consensus can be reached and that all relevant entities can identify potential contributions. The proposed architecture calls for a constellation of research and operational satellites, broad open data-sharing policies, and contingency planning. It includes agreements that are essential for bringing the same continuity to long-term and sustained climate observations available for weather observations. Space agencies can now use this report to create an end-to-end system for the delivery of long-term sustained observations of the Earth’s climate system.

## VISUALIZING NCDC DATA WITH THE WEATHER AND CLIMATE TOOLKIT

In 2013, NCDC further enhanced the Weather and Climate Toolkit (WCT) to provide support for exporting in Google Earth format and creating station time series structured according to established Discrete Sampling Geometries conventions. The WCT provides simple visualization and export of the weather and climate data archived at the Center, including radar, satellite, ground-based, and model data. Built upon scalable, open-source, and community-driven

software, the WCT offers ready access to a variety of users in the private, research, educational, and government sectors. NCDC also used the WCT to provide the public with visualizations of the May 2013 Moore, Oklahoma, Tornado and the September 2013 rainfall event near Boulder, Colorado. The NCDC developers of the WCT also received the NOAA Technology Transfer Award in 2013.

# Weather and Climate Toolkit

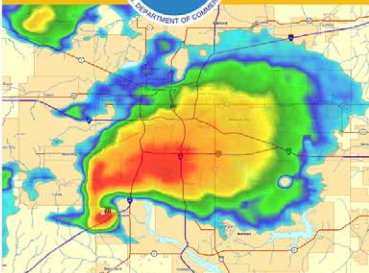



Allows the visualization and data export of weather and climate data, including radar, satellite, and model data.

Used by many groups, such as local, state, and federal agencies, educators, the private sector, and consulting meteorologists.

The data export feature supports conversion of the data to: KMZ, Shapefile, Well-Known Text, GeoTIFF, ESRI Grid, and Gridded NetCDF formats.

## Weather and Climate Toolkit



[www.ncdc.noaa.gov/wct/](http://www.ncdc.noaa.gov/wct/)

The NOAA Technology Transfer Award recognizes NOAA scientific, engineering, and technical employees for achievements that are developed further as commercial applications, or that advance the transfer of NOAA science and technology to U.S. businesses, academia, and other government and nongovernment entities. NCDC's Steve Ansari and Stephen Del Greco received this award for developing the Weather and Climate Toolkit to allow complex weather and climate data to be useful for a wide range of users in the public and private sectors.



Steve Ansari



Stephen Del Greco

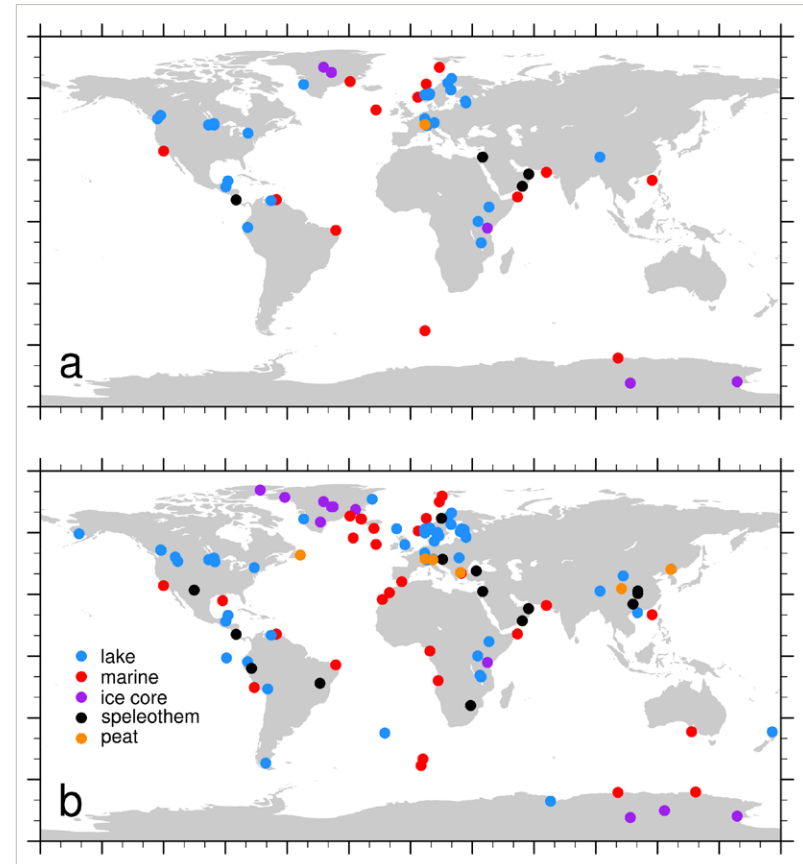


## CULTIVATING A NEW RECORD OF ABRUPT CLIMATE CHANGE

To examine the 8.2-kiloyear event, during which global temperatures suddenly decreased approximately 8,200 years before the present, NCDC scientists compiled 262 time series of observations from 114 sites to produce a structured, quality-controlled dataset that captured the overall effect of changes in meltwater input to the North Atlantic Ocean on the Earth's climate. The scientists used statistical methods to produce global anomaly maps for temperature and precipitation and compared the resulting global climate patterns to simulations of the event from three state-of-the-art climate models.

By using paleoclimate sources to document an event that has no equivalent in the instrumental record, scientists discovered that the climate response to a slowing down of the Atlantic Ocean circulation was more widespread than once thought. This study further increased scientific confidence that Atlantic Ocean circulation alters precipitation patterns and that the global climate can recover from short-term meltwater input events such as this one.

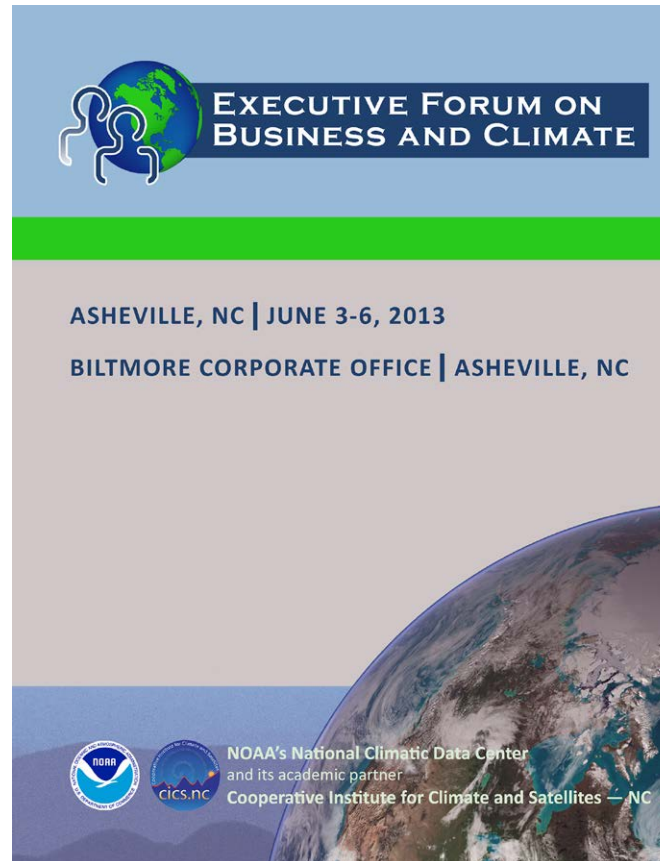
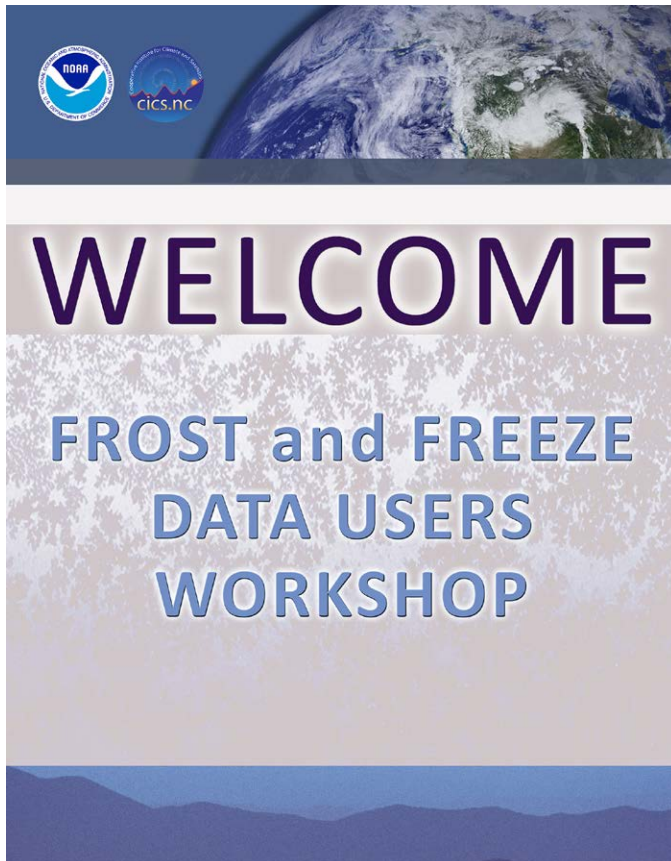
The 8.2-kiloyear event is the most recent of its kind similar to the possible future variations in Atlantic Ocean circulation due to current changes in the climate system. By documenting the climate response to this past circulation change, scientists can both better predict future climate risks and impacts and test the skill of models that make climate projections.



Location of high-resolution paleoclimate proxy records spanning 8.2 kiloyear that were available in (a) 2005 (Morrill and Jacobsen, 2005) and (b) 2012, color-coded by data type  
Carrie Morrill, NOAA affiliate

## AUGMENTING STORAGE FUNCTIONALITY WITH CLOUD SERVICES

The proper selection of specific technologies can help data centers like NCDC make knowledgeable decisions about when, where, and how to utilize them. In an effort to employ the best technologies to advance the Center's mission of science, service, and stewardship, NCDC worked closely with the other NOAA data centers and the Comprehensive Large Array-Data Stewardship System to procure public cloud storage for testing dissemination options and configuring the private cloud environment for storage and elastic computing. By examining technical hurdles and reviewing cost comparisons of cloud storage options, NCDC gained the necessary knowledge to significantly improve the Center's ability to make intelligent and cost effective decisions in utilizing cloud technologies.



## ENGAGING USERS WITH WORKSHOPS AND FORUMS

In 2013, NCDC collaborated with the Cooperative Institute for Climate and Satellites—North Carolina (CICS-NC) to host two workshops and two forums to engage climate data users and business leaders. One of these was the “Frost and Freeze Data and Impacts to the Agriculture, Construction, and Transportation Industry” workshop held in March. The two-day workshop interaction focused on informing users of NCDC data offerings for sector-specific climate information

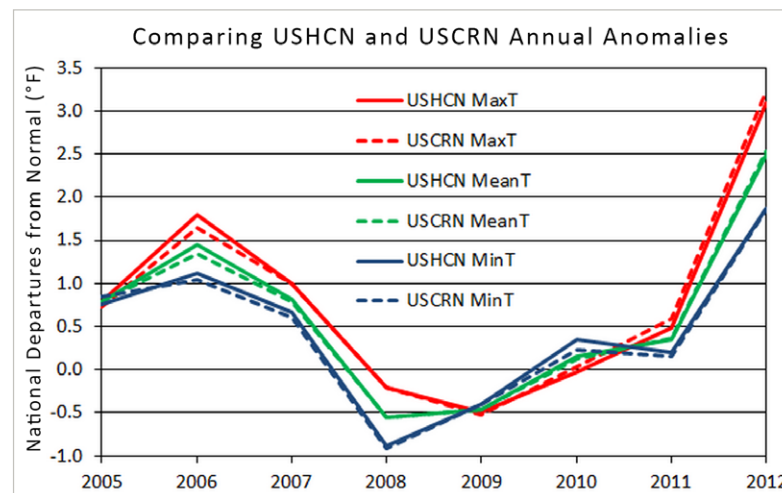
needs and providing relevant information to the industries that are the most vulnerable and susceptible to changes in freezing conditions. Another similar workshop entitled, “Climate Data and Applications Workshop: A Focus on Precipitation” was held at NCDC in December 2013. This two-day workshop focused on the different types of precipitation data, from land-based to remotely sensed observations, available from CICS-NC and NCDC, as well as examples of how the data are useful in various applications.

Additionally, NCDC and CICS-NC hosted the inaugural “Executive Forum on Business and Climate” in June in Asheville, North Carolina. This forum brought together business and industry leaders, academic researchers, and climate science experts to collectively examine weather and climate science trends, observations and predictions, related business risks, impacts and opportunities, and current market trends. The forum engaged participants through a combination of interactive discussions, case studies, and scenario-planning activities. CICS-NC also partnered with the Center for Climate and Energy Solutions (C2ES) to host a follow-up forum, “Identifying Business / Industry Needs for Resilience Planning,” in Washington, DC, in November. This second Executive Forum on Business and Climate served as a knowledge exchange seminar and networking activity built around discussions on climate-related risks and opportunities for private sector businesses.

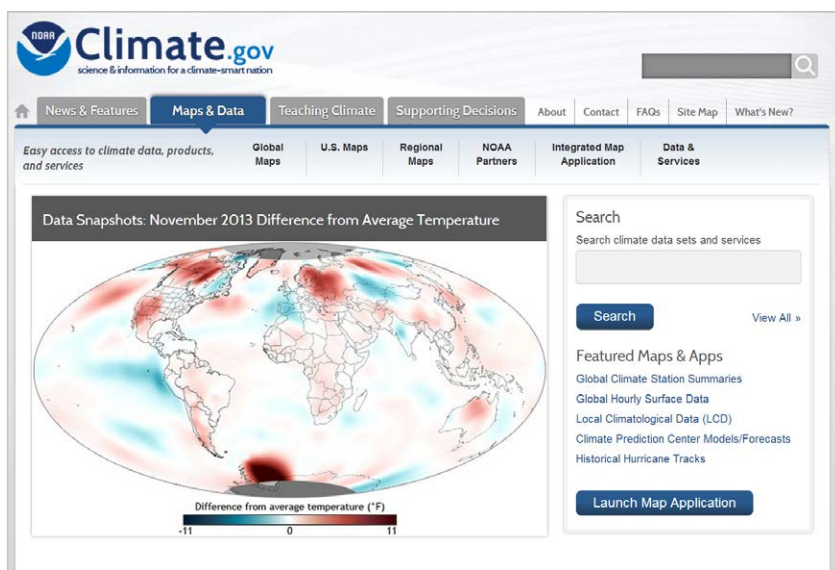


## LAUNCHING THE NATIONAL TEMPERATURE INDEX PAGE

NCDC currently maintains methods for computing the U.S. average temperature based on archives of temperature measurements from two different observing networks: the U.S. Climate Reference Network (USCRN) that dates back to the 2000s and the U.S. Historical Climatology Network (USHCN) that dates back to the late 1800s. To provide the public an easy way to compare temperature data from these two sources, NCDC created the National Temperature Index page. Using a complex multistep process, NCDC created an index of temperature anomalies for each of these datasets in relation to a 1981–2010 reference period that updates dynamically each month. Users of the National Temperature Index page can compare the anomaly values from each of the datasets on 1-month, 3-month, 6-month, and 12-month timescales. This tool also demonstrates that the established USHCN—used for many years in a variety of climate analyses—produces robust results when compared to the highest quality measurements of air temperature taken at USCRN stations. The page also provides users with a variety of detailed background information, ensuring the public of NCDC’s mission to employ rigorous refereed science, validated data integrity, and transparent analysis methods.



Comparison of annual national anomalies for the USHCN (solid) and USCRN (dashed) maximum (red), mean (green), and minimum (blue) temperatures



## REDESIGNING NOAA'S CLIMATE PORTAL

NOAA's Climate Portal, [www.climate.gov](http://www.climate.gov), provides science and services for a climate-smart Nation. The Climate Portal team cuts across NOAA, including NCDC, the Climate Program Office, the Coastal Services Center, and the Climate Prediction Center. The Portal offers a user-friendly point of entry to NOAA's diverse portfolio of climate data and information, making products and services easy to access. Data and information in the portal can be readily used by the private sector, individuals with very specific questions, and educators.

NCDC contributed to enhancements and upgrades to the portal and continued as its host in 2013. The redesigned interface utilizes a new content management system to more efficiently manage and update content. The team added 102 new datasets and products to the "Maps and Data" section; published 82 new

articles, videos, and images in the "News and Features" section; and added 537 new resources in the "Teaching Climate" section of the site. Overall, the site experienced a 150% increase in visits from the 2012 to 2013 fiscal year.



## PARTNERING WITH THE COOPERATIVE INSTITUTE FOR CLIMATE AND SATELLITES-NORTH CAROLINA

The Cooperative Institute for Climate and Satellites–North Carolina (CICS-NC) supports NCDC’s mission of enhancing the collective interdisciplinary understanding of the state and evolution of the full Earth system. Over the past year, CICS-NC research activities have grown and advanced with approximately 50 peer-reviewed papers published and over 50 presentations at several dozen conferences, meetings, and workshops. Moreover, CICS had an overall successful mid-term review and has been recommended for an additional five years of support.

The CICS-NC team continues to demonstrate leadership and drive innovation, both nationally and internation-

ally, through contributions to the third National Climate Assessment, the International Surface Temperature Initiative, the World Climate Research Programme Data Advisory Council, and the American Meteorological Society Energy Committee.



CICS-NC *inspires* cutting-edge research and collaboration.

CICS-NC *advances* NOAA’s mission to understand and communicate the current and future state of the climate.

CICS-NC *engages* with business, industry, academia, and the public to enhance decision making.

## REMOVING DUPLICATE PHYSICAL RECORDS FROM NCDC’S ARCHIVE

Since its inception under the management of NCDC, the Climate Database Modernization Program has scanned 56 million physical weather records and made the digitized copies available to users. However, many of those physical records remain stored in the NCDC archive. To eliminate storing duplicate digital and physical records, NCDC coordinated with the National Archive and Records Administration to document the digital images as the authoritative copies of the data. The duplicate physical records were removed and the remaining were consolidated, reducing the space they occupy by about half and saving the Center approximately \$250,000 per year in rent.



## ENSURING AN OPERATIONAL, EFFECTIVE, AND SAFE WORK ENVIRONMENT

Every year NCDC puts forth great effort in monitoring and safeguarding the facility's operations. In 2013, the Center worked to reduce the amount of physical space it leases from the U.S. General Services Administration (GSA). This effort relocated the NCDC library and reduced space needed for the physical archive, vastly reducing rent expenses. NCDC also ensured that all major facilities infrastructure systems were covered by support contracts, including a preventive maintenance contract and extended warranty for the Center's generator. NCDC promoted a safe work environment in 2013 by supporting the implementation of the NOAA Emergency Notification System, working with GSA to resolve parking lot safety issues, providing each division in the Center with a first aid kit, adding a second automated external defibrillator in the building, and leading an update of the building-wide Occupant Emergency Plan.



## EVALUATING AND ENHANCING INFORMATION TECHNOLOGY OPERATIONS

As part of the Federal Data Center Consolidation effort, the Office of Management and Budget evaluated NCDC's server floor for operational efficiency, giving the Center a 7-out-of-9 rating. This rating places NCDC in the top tier of NOAA facilities along with state-of-the-art, purpose-built data centers. During 2013, NCDC information technology security experienced many changes, taking significant steps to improve the Center's system security posture. In addition, NCDC continues to coordinate with higher levels of the organization to integrate with pending Enterprise Level Services. NCDC continues to meet current and future user requirements. In 2013, NCDC completed the design of a modernized server infrastructure, and in 2014, NCDC will apply several innovations to legacy processes to realize its potential. From virtual networks that separate operational processes and data from their development counterparts to shared storage and the ability to dynamically apply more resources to the applications that need them, our modernized computing infrastructure is ready for business.



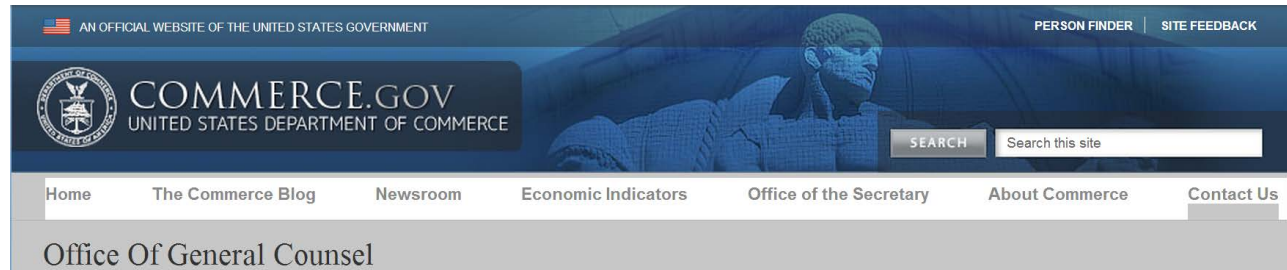
## UTILIZING FUNDS AND GRANTS EFFECTIVELY

In 2013, NCDC worked diligently to improve its internal process for assigning shared costs to all incoming projects and programs in a manner consistent with appropriations and fiscal law. The Department of Commerce Office of General Counsel reviewed this new process and praised it for its simplicity and purity of logic, ultimately approving it as a sound business practice.

NCDC also continued to conscientiously steward the American public's resources, awarding \$9.3 million in grants and successfully executing a \$65 million budget. Of the \$9.3 million in grants, NCDC awarded \$7.5 million to the Cooperative Institute for Climate and Satellites–North Carolina for 14 new and multiyear proposals, employing more than 30 onsite personnel. Toward executing the \$65 million budget, NCDC developed a Budget Guidance Memo that, when coupled with advanced financial planning by program managers and project leads, enabled NCDC to navigate a fiscal year marked by significant financial uncertainty. All of these efforts further advanced the Center toward a more robust and resilient budget planning and execution process.

## VENTURING INTO SOCIAL MEDIA WITH PARTNERS, CONSTITUENTS, AND THE PUBLIC

Since December 2012, NCDC has been engaging its partners, constituents, and the public with a social media presence on Twitter and Facebook. Throughout 2013, NCDC gained over 4,500 followers on Twitter and over 2,400 likes on Facebook. Utilizing social media has allowed NCDC to virtually connect with people all over the world by capitalizing on the viral nature of the communication medium. With just one post on Twitter, NCDC reached over 440,000 people and with just one post on Facebook, reached over 57,000 people. Social media also provides the Center with great exposure for its products and services and allows it to establish integrity and values by being transparent. NCDC has also been able to more effectively build relationships and have conversations with its customers and to humanize its products and services, giving the Center a voice.





# AWARDS

The Gold Medal is the highest honorary award granted by the Secretary of Commerce, recognizing distinguished performance characterized by extraordinary, notable or prestigious contributions that impact the mission of the Department.

This year the Suomi National Polar-Orbiting Partnership team was awarded this honor for their critical work in preparing, testing and implementing the archive requirements for the Suomi NPP Partnership Ground System.

Standing (left to right): Walter J. Glance, Jr., Drew T. Saunders, J. Kern Witcher, James J. Goudouros.

Seated (left to right): Jay Morris, Nancy A. Ritchey, Axel Graumann, Dean J. Carter.

Rick Vizbulis (not shown in photo)



## Congratulations to the NCDC graduates of the 2013 Combined Leadership Development Program

These demanding development programs are designed to train and enhance leadership skills while maintaining current job duties, and graduating from these programs demonstrates exceptional dedication and motivation.

Edward J. Kearns - Senior Executive Service Candidate Development Program (SESCDP)

Nancy Ritchey - Executive Leadership Development Program (ELDP)



Edward J. Kearns



Nancy A. Ritchey

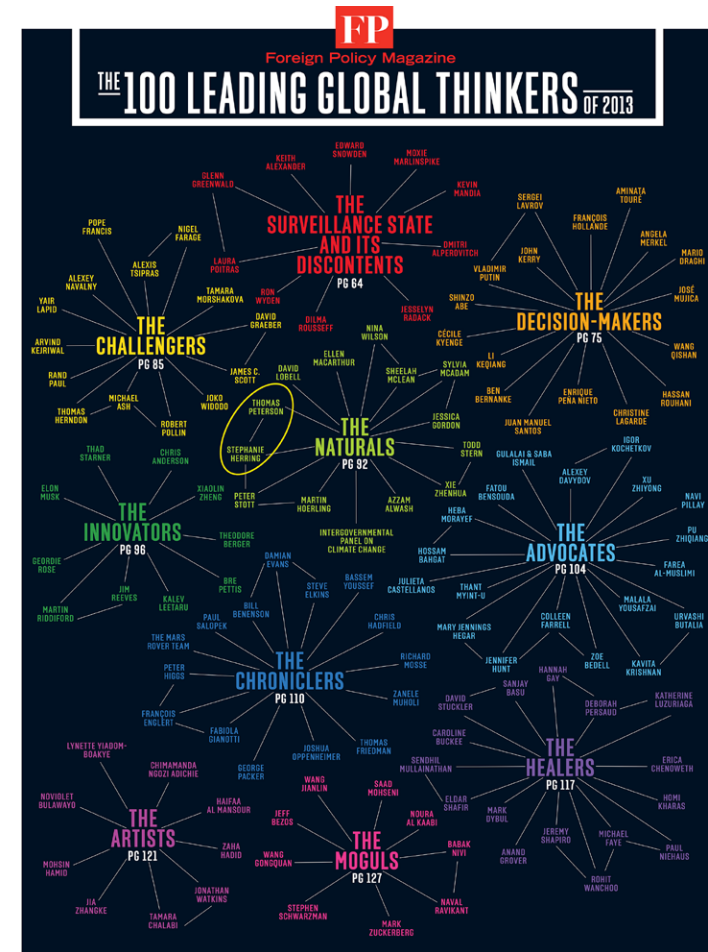
# AWARDS

## Extreme events report puts NOAA climate scientists in list of Top 100 Global Thinkers

Earlier this fall, the *Bulletin of the American Meteorological Society* published a report on extreme weather and climate events from 2012. The second in a new annual series, the report sought to explain the natural and human-caused climate factors that shaped some of the year's extreme weather events. Last month, the report's editors—three NOAA scientists and a colleague from the UK Met Office—were surprised to learn they'd be rubbing shoulders with leading international thinkers on Foreign Policy Magazine's annual list of "Top 100 Global Thinkers."

Thomas Peterson, Martin Hoerling, Stephanie Herring, all from NOAA, and Peter Stott, from the UK Met Office, appear in the list's "Leading Global Thinkers: Naturals" category. Foreign Policy's editors say they were chosen for coordinating a groundbreaking collection of studies that "pointed problem-solvers in the right direction" of how to answer tough questions about the role of natural variability and global warming in extreme weather and climate events.

As editors, says Peterson, it's their job to turn the inspiration and creativity of dozens of scientists from around the world into the reality of a peer-reviewed, easy-to-understand collection of studies that others can read and learn from. While they are excited to be included on the list, the editors all shared Hoerling's sentiments that the award "honors the collective effort" of everyone in the climate research community who works to understand what causes extreme events and how they effect society.





# BIBLIOGRAPHY

## NCDC Publications for 2013

### Scientific Papers

Akyüz, A., K. Shein, and M. Asmus, 2013: Procedure for assigning a value for trace precipitation data without changing the climatic history. *Journal of Service Climatology*, **6**, Article 1. Online at [http://www.journalofserviceclimatology.org/articles/2013/Adnan\\_et\\_al\\_2013.pdf](http://www.journalofserviceclimatology.org/articles/2013/Adnan_et_al_2013.pdf)

Anderson, D.M., E. M. Mauk, E. R. Wahl, C. Morrill, A. J. Wagner, D. Easterling, and T. Rutishauser, 2013: Global warming in an independent record of the past 130 years. *Geophysical Research Letters*, **40**, 189–193, [doi:10.1029/2012GL054271](https://doi.org/10.1029/2012GL054271).

Arguez, A., and S. Applequist, 2013: A harmonic approach for calculating daily temperature normals constrained by homogenized monthly temperature normals. *Journal of Atmospheric and Oceanic Technology*, **30**, 1259–1265, [doi:10.1175/JTECH-D-12-00195.1](https://doi.org/10.1175/JTECH-D-12-00195.1).

Arguez, A., T.R. Karl, M.F. Squires, and R.S. Vose, 2013: Uncertainty in annual rankings from NOAA's global temperature time series. *Geophysical Research Letters*, **40**, 5965–5969, [doi:10.1002/2013GL057999](https://doi.org/10.1002/2013GL057999).

Arguez, A., R.S. Vose, and J. Dissen, 2013: Alternative climate normals: Impacts to the energy industry. *Bulletin of the American Meteorological Society*, **94**, 915–917, [doi:10.1175/BAMS-D-12-00155.1](https://doi.org/10.1175/BAMS-D-12-00155.1).

Banzon, V.F., and R.W. Reynolds, 2013: Use of WindSat to extend a microwave-based daily optimum interpolation sea surface temperature time series. *Journal of Climate*, **26**, 2557–2562, [doi:10.1175/JCLI-D-12-00628.1](https://doi.org/10.1175/JCLI-D-12-00628.1).

Bell, J.E., M.A. Palecki, W.G. Collins, J.H. Lawrimore, R.D. Leeper, M.E. Hall, J. Kochendorfer, T.P. Meyers, T. Wilson, C.B. Baker, and H.J. Diamond, 2013: U.S. Climate Reference Network soil moisture and temperature observations. *Journal of Hydrometeorology*, **14**, 977–988, [doi:10.1175/JHM-D-12-0146.1](https://doi.org/10.1175/JHM-D-12-0146.1).

Brown, P.J., and A.T. DeGaetano, 2013: Trends in U.S. surface humidity, 1930–2010. *Journal of Applied Meteorology and Climatology*, **52**, 147–163, [doi:10.1175/JAMC-D-12-035.1](https://doi.org/10.1175/JAMC-D-12-035.1).

Chan, P. K., X.-P. Zhao, and A. K. Heidinger, 2013: Long-term aerosol climate data record derived from operational AVHRR satellite observations. *Dataset Papers in Geosciences*, **2013**, Article ID 140791, [doi:10.7167/2013/140791](https://doi.org/10.7167/2013/140791).

Diamond, H.J., T.R. Karl, M.A. Palecki, C.B. Baker, J.E. Bell, R.D. Leeper, D.R. Easterling, J.H. Lawrimore, T.P. Meyers, M.R. Helfert, G. Goodge, and P.W. Thorne, 2013: U.S. Climate Reference Network after one decade of operations: Status and assessment. *Bulletin of the American Meteorological Society*, **94**, 485–498, [doi:10.1175/BAMS-D-12-00170](https://doi.org/10.1175/BAMS-D-12-00170).

Donat, M.G., L.V. Alexander, H. Yang, I. Durre, R. Vose, and J. Caesar, 2013: Global land-based datasets for monitoring climatic extremes. *Bulletin of the American Meteorological Society*, **94**, 997–1006, [doi:10.1175/BAMS-D-12-00109](https://doi.org/10.1175/BAMS-D-12-00109).

- Donat, M.G., L.V. Alexander, H. Yang, I. Durre, R. Vose, ..., T.C. Peterson, et al., 2013: Updated analyses of temperature and precipitation extreme indices since the beginning of the twentieth century: The HadEX2 dataset. *Journal of Geophysical Research: Atmospheres*, **118**, 2098–2118, [doi:10.1002/jgrd.50150](https://doi.org/10.1002/jgrd.50150).
- Donat, M.G., T.C. Peterson, et al., 2013: Changes of extreme temperature and precipitation in the Arab region: long-term trends and variability related to ENSO and NAO. *International Journal of Climatology*, Early View, [doi:10.1002/joc.3707](https://doi.org/10.1002/joc.3707).
- Durre, I., M.F. Squires, R. S. Vose, X. Yin, A. Arguez, and S. Applequist, 2013: NOAA's 1981–2010 U.S. climate normals: Monthly precipitation, snowfall, and snow depth. *Journal of Applied Meteorology and Climatology*, **52**, 2377–2395, [doi:10.1175/JAMC-D-13-051.1](https://doi.org/10.1175/JAMC-D-13-051.1).
- El Fadli, K.I., ..., T.C. Peterson, et al., 2013: World Meteorological Organization assessment of the purported world record 58°C temperature extreme at El Azizia, Libya (13 September 1922). *Bulletin of the American Meteorological Society*, **94**, 199–204, [doi:10.1175/BAMS-D-12-00093.1](https://doi.org/10.1175/BAMS-D-12-00093.1).
- Gallant, A., D. Karoly, and K. Gleason, 2013: Consistent trends in modified climate extremes index in the U.S.A., Europe and Australia. *Journal of Climate*, in press, [doi:10.1175/JCLI-D-12-00783.1](https://doi.org/10.1175/JCLI-D-12-00783.1).
- Gilford, D., S. Smith, M. Griffin, and A. Arguez, 2013: Southeastern United States daily temperature ranges associated with the El Niño–Southern Oscillation. *Journal of Applied Meteorology and Climatology*, **52**, 2434–2449, [doi:10.1175/JAMC-D-12-0273.1](https://doi.org/10.1175/JAMC-D-12-0273.1).
- Gottschalk, J., P.E. Roundy, C.J. Schreck III, A. Vintzileos, and C. Zhang, 2013: Large-scale atmospheric and oceanic conditions during the 2011–12 DYNAMO Field Campaign. *Monthly Weather Review*, **141**, 4173–4196, [doi:10.1175/MWR-D-13-00022.1](https://doi.org/10.1175/MWR-D-13-00022.1).
- Guillevic, P.C., A. Bork-Unkelbach, F.M. Gottsche, G. Hulley, J.-P. Gastellu-Etchegorry, F.S. Olesen, and J.L. Privette, 2013: Directional viewing effects on satellite land surface temperature products over sparse vegetation canopies—A multisensor analysis. *Geoscience and Remote Sensing Letters*, **10**, 1646–1468, [doi:10.1109/LGRS.2013.2260319](https://doi.org/10.1109/LGRS.2013.2260319).
- Habib, E., L. Qin, D. Seo, G. Ciach, and B. Nelson, 2013: Independent assessment of incremental complexity in NWS multisensor precipitation estimator algorithms. *Journal of Hydrologic Engineering*, **18**, 143–155, [doi:10.1061/\(ASCE\)HE.1943-5584.0000638](https://doi.org/10.1061/(ASCE)HE.1943-5584.0000638).
- Hausfather, Z., M.J. Menne, C.N. Williams, T. Masters, R. Broberg, and D. Jones, 2013: Quantifying the impact of urbanization on U.S. Historical Climatology Network temperature records. *Journal of Geophysical Research Atmospheres*, **118**, 481–494, [doi:10.1029/2012JD018509](https://doi.org/10.1029/2012JD018509).
- Heidinger, A.K., M.J. Foster, A. Walther, and X. (T.) Zhao, 2013: The Pathfinder Atmospheres Extended (PATMOS-x) AVHRR climate data set. *Bulletin of the American Meteorological Society*, in press, [doi:10.1175/BAMS-D-12-00246.1](https://doi.org/10.1175/BAMS-D-12-00246.1).
- Huang, B., M. L'Heureux, J. Lawrimore, C. Liu, H.-M. Zhang, V. Banzon, Z.-Z. Hu, and A. Kumar, 2013: Why did large differences arise in the sea surface temperature datasets across the tropical Pacific during 2012? *Journal of Atmospheric and Oceanic Technology*, **30**, 2944–2953, [doi:10.1175/JTECH-D-13-00034.1](https://doi.org/10.1175/JTECH-D-13-00034.1).
- Knapp, K.R., J.A. Knaff, C.R. Sampson, G.M. Riggio, and A.D. Schnapp, 2013: A pressure-based analysis of the historical western North Pacific tropical cyclone intensity record. *Monthly Weather Review*, **141**, 2611–2631, [doi:10.1175/MWR-D-12-00323.1](https://doi.org/10.1175/MWR-D-12-00323.1).
- Kossin, J., T. Olander, and K. Knapp, 2013: Trend analysis with a new global record of tropical cyclone intensity. *Journal of Climate*, **26**, 9960–9976, [doi:10.1175/JCLI-D-13-00262.1](https://doi.org/10.1175/JCLI-D-13-00262.1).
- Kruk, M.C., J.J. Marra, et al., 2013: Pacific Storms Climatology Products (PSCP): Understanding extreme events. *Bulletin of the American Meteorological Society*, **94**, 13–18, [doi:10.1175/BAMS-D-11-00075.1](https://doi.org/10.1175/BAMS-D-11-00075.1).
- Kunkel, K.E., T.R. Karl, H. Brooks, J. Kossin, J.H. Lawrimore, D. Arndt, ... P.Ya. Groisman, ..., T.C. Peterson, ..., R. Vose, et al., 2013: Monitoring and understanding trends in extreme storms: State of knowledge. *Bulletin of the American Meteorological Society*, **94**, 499–514, [doi:10.1175/BAMS-D-11-00262.1](https://doi.org/10.1175/BAMS-D-11-00262.1).
- Kunkel, K.E., T.R. Karl, D.R. Easterling, K. Redmond, J. Young, X. Yin, and P. Hennon, 2013: Probable maximum precipitation (PMP) and climate change. *Geophysical Research Letters*, **40**, 1402–1408, [doi:10.1002/grl.50334](https://doi.org/10.1002/grl.50334).



- Landrum, L., B. Otto-Bliesner, E. Wahl, A. Conley, P. Lawrence, N. Rosenbloom, and H. Teng, 2013: Last millennium climate and its variability in CCSM4. *Journal of Climate*, **26**, 1085–1111, [doi:10.1175/JCLI-D-11-00326.1](https://doi.org/10.1175/JCLI-D-11-00326.1).
- Lattanzio, A., J. Schulz, J. Matthews, ..., J.J. Bates, K.R. Knapp, Y. Kosaka, and L. Schüller, 2013: Land surface albedo from geostationary satellites: A multi-agency collaboration within SCOPE-CM. *Bulletin of the American Meteorological Society*, **94**, 205–214, [doi:10.1175/BAMS-D-11-00230.1](https://doi.org/10.1175/BAMS-D-11-00230.1).
- Li, Y., and C. Morrill, 2013: Lake levels in Asia at the Last Glacial Maximum and implications for future changes in the hydrologic cycle. *Quaternary Science Reviews*, **60**, 1–12, [doi:10.1016/j.quascirev.2012.10.045](https://doi.org/10.1016/j.quascirev.2012.10.045).
- Lippmann, S.J., C.M. Fuhrmann, A.E. Waller, and D.B. Richardson, 2013: Ambient temperature and emergency department visits for heat-related illness in North Carolina, 2007–2008. *Environmental Research*, **124**, 35–42, [doi:10.1016/j.envres.2013.03.009](https://doi.org/10.1016/j.envres.2013.03.009).
- Matthews, J.L., R.C. Smith, and E.L. Fiscus, 2013: Confidence interval estimation for an empirical model quantifying the effect of soil moisture and plant development on soybean (Glycine max (L.) Merr.) leaf conductance. *International Journal of Pure and Applied Mathematics*, **83**, 439–464, [doi:10.12732/ijpam.v83i3.6](https://doi.org/10.12732/ijpam.v83i3.6).
- Matthews, J.L., E.L. Fiscus, R.C. Smith, and J.L. Heitman, 2013: Quantifying plant age and available water effects on soybean leaf conductance. *Agronomy Journal*, **105**, 28–36, [doi:10.2134/agronj2012.0263](https://doi.org/10.2134/agronj2012.0263).
- Morrill, C., 2013: Paleaeoclimate: Asian connections. *Nature Geoscience*, **6**, 91–92, [doi:10.1038/ngeo1718](https://doi.org/10.1038/ngeo1718).
- Morrill, C., D.M. Anderson, B.A. Bauer, R. Buckner, E.P. Gille, W.S. Gross, M. Hartman, and A. Shah, 2013: Proxy benchmarks for intercomparison of 8.2 ka simulations. *Climate of the Past*, **9**, 423–432, [doi:10.5194/cp-9-423-2013](https://doi.org/10.5194/cp-9-423-2013).
- Morrill, C., A.N. LeGrande, H. Renssen, P. Bakker, and B.L. Otto-Bliesner, 2013: Model sensitivity to North Atlantic freshwater forcing at 8.2 ka. *Climate of the Past*, **9**, 955–968, [doi:10.5194/cp-9-955-2013](https://doi.org/10.5194/cp-9-955-2013).
- Nogueira, R.C., B.D. Keim, D.P. Brown, and K.D. Robbins, 2013: Variability of rainfall from tropical cyclones in the eastern USA and its association to the AMO and ENSO. *Theoretical and Applied Climatology*, **112**, 273–283, [doi:10.1007/s00704-012-0722-y](https://doi.org/10.1007/s00704-012-0722-y).
- PAGES 2k Consortium including: E.R. Wahl, and H. Diaz, 2013: Continental-scale temperature variability during the last two millennia. *Nature Geoscience*, **6**, 339–346, [doi:10.1038/ngeo1797](https://doi.org/10.1038/ngeo1797).
- Palecki, M.A., and J.E. Bell, 2013: U.S. Climate Reference Network soil moisture observations with triple redundancy: Measurement variability. *Vadose Zone Journal*, **12**, [doi:10.2136/vzj2012.0158](https://doi.org/10.2136/vzj2012.0158).
- Pendleton, L., T.R. Karl, and E. Mills, 2013: Economic growth in the face of weather and climate extremes: A call for better data. *Eos, Transactions of the American Geophysical Union*, **94**, 225–226, [doi:10.1002/2013EO250005](https://doi.org/10.1002/2013EO250005).
- Peng, G., W.N. Meier, D.J. Scott, and M.H. Savoie, 2013: A long-term and reproducible passive microwave sea ice concentration data record for climate studies and monitoring. *Earth System Science Data*, **5**, 311–318, [doi:10.5194/essd-5-311-2013](https://doi.org/10.5194/essd-5-311-2013).
- Peng, G., H.-M. Zhang, H.P. Frank, J.-R. Bidlot, M. Higaki, S. Stevens, and W.R. Hankins, 2013: Evaluation of various surface wind products with OceanSITES buoy measurements. *Weather and Forecasting*, **28**, 1281–1303, [doi:10.1175/WAF-D-12-00086.1](https://doi.org/10.1175/WAF-D-12-00086.1).
- Peterson, T.C., R.R. Heim, Jr., ..., T.R. Karl, R.W. Katz, K. Kunkel, B.C. Stewart, ..., R.S. Vose, et al., 2013: Monitoring and understanding changes in heat waves, cold waves, floods and droughts in the United States: State of knowledge. *Bulletin of the American Meteorology Society*, **94**, 821–834, [doi:10.1175/BAMS-D-12-00066.1](https://doi.org/10.1175/BAMS-D-12-00066.1).
- Pozzi, W., J. Sheffield, ..., R.R. Heim, Jr., M.J. Brewer, et al., 2013: Toward global drought early warning capability: Expanding international cooperation for the development of a framework for monitoring and forecasting. *Bulletin of the American Meteorological Society*, **94**, 776–785, [doi:10.1175/BAMS-D-11-00176.1](https://doi.org/10.1175/BAMS-D-11-00176.1).

- Prat, O.P., and B.R. Nelson, 2013: Characteristics of annual, seasonal, and diurnal precipitation in the southeastern United States derived from long-term remotely sensed data. *Atmospheric Research*, in press, [doi:10.1016/j.atmosres.2013.07.022](https://doi.org/10.1016/j.atmosres.2013.07.022).
- Prat, O.P., and B.R. Nelson, 2013: Mapping the world's tropical cyclone rainfall contribution over land using the TRMM Multi-satellite Precipitation Analysis. *Water Resources Research*, **49**, 7236–7254, [doi:10.1002/wrcr.20527](https://doi.org/10.1002/wrcr.20527).
- Prat, O.P., and B.R. Nelson, 2013: Precipitation contribution of tropical cyclones in the southeastern United States from 1998 to 2009 using TRMM satellite data. *Journal of Climate*, **26**, 1047–1062, [doi:10.1175/JCLI-D-11-00736.1](https://doi.org/10.1175/JCLI-D-11-00736.1).
- Rutherford, S., M.E. Mann, E. Wahl, and C. Ammann, 2013: Comments on: Erroneous model field representations in multiple pseudoproxy studies: Corrections and Implications. *Journal of Climate*, **26**, 3482–3284, [doi:10.1175/JCLI-D-12-00065.1](https://doi.org/10.1175/JCLI-D-12-00065.1).
- Schreck III, C.J., J.M. Cordeira, and D. Margolin, 2013: Which MJO Events Affect North American Temperatures? *Monthly Weather Review*, **141**, 3840–3850, [doi:10.1175/MWR-D-13-00118.1](https://doi.org/10.1175/MWR-D-13-00118.1).
- Schreck III, C.J., L. Shi, J.P. Kossin, and J.J. Bates, 2013: Identifying the MJO, equatorial waves, and their impacts using 32 Years of HIRS upper-tropospheric water vapor. *Journal of Climate*, **26**, 1418–1431, [doi:10.1175/JCLI-D-12-00034.1](https://doi.org/10.1175/JCLI-D-12-00034.1).
- Shah, A., C. Morrill, E. Gille, W. Gross, D.M. Anderson, B. Bauer, R. Buckner, and M. Hartman, 2013: Global speleothem oxygen isotope measurements since the Last Glacial Maximum. *Dataset Papers in Geoscience*, Article ID 548048, [doi:10.7167/2013/548048](https://doi.org/10.7167/2013/548048).
- Shein, K.A., et al., 2013: Revisiting the statewide climate extremes for the United States--Evaluating existing extremes, archived data, and new observations. *Bulletin of the American Meteorological Society*, **94**, 393–402, [doi:10.1175/BAMS-D-11-00013.1](https://doi.org/10.1175/BAMS-D-11-00013.1).
- Shi, L., 2013: Intersatellite differences of HIRS longwave channels between NOAA-14 and NOAA-15 and between NOAA-17 and METOP-A. *IEEE Transactions on Geoscience and Remote Sensing*, **51**, 1414–1424, [doi:10.1109/TGRS.2012.2216886](https://doi.org/10.1109/TGRS.2012.2216886).
- Shi, L., C.J. Schreck III, and V.O. John, 2013: HIRS channel-12 brightness temperature dataset and its correlations with major climate indices. *Atmospheric Chemistry and Physics*, **13**, 6907–6920, [doi:10.5194/acp-13-6907-2013](https://doi.org/10.5194/acp-13-6907-2013).
- Smith, A.B. and R. Katz, 2013: U.S. Billion-dollar weather and climate disasters: Data sources, trends, accuracy and biases. *Natural Hazards*, **67**, 387–410, [doi:10.1007/s11069-013-0566-5](https://doi.org/10.1007/s11069-013-0566-5).
- Trouet, V., H.F. Diaz, E.R. Wahl, A. Viau, R. Graham, N. Graham, and E.R. Cook, 2013: A 1500-year reconstruction of annual mean temperature for temperate North America on decadal-to-multidecadal time scales. *Environmental Research Letters*, **8**, 024008, [doi:10.1088/1748-9326/8/2/024008](https://doi.org/10.1088/1748-9326/8/2/024008).
- Wagner, A., C. Morrill, B.L. Otto-Bliesner, N. Rosenbloom, and K.R. Watkins, 2013: Model support for forcing of the 8.2 ka event by meltwater from the Hudson Bay ice dome. *Climate Dynamics*, **41**, 2855–2873, [doi:10.1007/s00382-013-1706-z](https://doi.org/10.1007/s00382-013-1706-z).
- Willett, K.M., C.N. Williams Jr., R. J.H. Dunn, P.W. Thorne, S. Bell, M. de Podesta, P.D. Jones, and D.E. Parker, 2013: HadISDH: An updateable land surface specific humidity product for climate monitoring. *Climate of the Past*, **9**, 657–677, [doi:10.5194/cp-9-657-2013](https://doi.org/10.5194/cp-9-657-2013).
- Wuebbles, D., G. Meehl, K. Hayhoe, T.R. Karl, K. Kunkel, et al., 2013: CMIP5 climate model analyses: Climate extremes in the United States. *Bulletin of the American Meteorological Society*, in press, [doi:10.1175/BAMS-D-12-00172.1](https://doi.org/10.1175/BAMS-D-12-00172.1).
- Ventrice, M.J., M.C. Wheeler, H.H. Hendon, C.J. Schreck, C.D. Thorncroft, and G.N. Kiladis, 2013: A modified multivariate Madden–Julian oscillation index using velocity potential. *Monthly Weather Review*, **141**, 4197–4210, [doi:10.1175/MWR-D-12-00327.1](https://doi.org/10.1175/MWR-D-12-00327.1).
- Vose, R.S., S. Applequist, ..., D.R. Easterling, R.E. Jensen, T.R. Karl, ..., M.C. Kruk, K.E. Kunkel, M.C. MacCracken, T.C. Peterson, K. Shein, et al., 2013: Monitoring and understanding changes in extremes: Extratropical storms, winds and waves. *Bulletin of the American Meteorology Society*, in press, [doi:10.1175/BAMS-D-12-00162.1](https://doi.org/10.1175/BAMS-D-12-00162.1).



- Yan, L., Y. Luo, R.A. Sherry, J.E. Bell, X. Zhou, and J. Xia, 2013: Rain use efficiency as affected by climate warming and biofuel harvest: Results from a 12-year field experiment. *GCB Bioenergy*, Early View, [doi:10.1111/gcbb.12081](https://doi.org/10.1111/gcbb.12081).
- Young, A.H., J.J. Bates, and J.A. Curry, 2013: Application of cloud vertical structure from CloudSat to investigate MODIS-derived cloud properties of cirriform, anvil, and deep convective clouds. *Journal of Geophysical Research*, **118**, 4689–4699, [doi:10.1002/jgrd.50306](https://doi.org/10.1002/jgrd.50306).
- Zhang, Y., E. Habib, R.J. Kuligowski, and D. Kim, 2013: Joint distribution of multiplicative errors in radar and satellite QPEs and its use in estimating the conditional exceedance probability. *Advances in Water Resources*, **59**, 133–145, [doi:10.1016/j.advwatres.2013.06.004](https://doi.org/10.1016/j.advwatres.2013.06.004).
- Zhao, X.-P., P.K. Chan, and A.K. Heidinger, 2013: A global survey of the effect of cloud contamination on the aerosol optical thickness and its long-term trend derived from operational AVHRR satellite observations. *Journal of Geophysical Research: Atmospheres*, **118**, 2849–2857, [doi:10.1002/jgrd.50278](https://doi.org/10.1002/jgrd.50278).
- Zolina, O., C. Simmer, ..., P. Groisman, 2013: New view on precipitation variability and extremes in Central Europe from a German high resolution daily precipitation dataset: Results from the STAMMEX project. *Bulletin of the American Meteorological Society*, in press, [doi:10.1175/BAMS-D-12-00134.1](https://doi.org/10.1175/BAMS-D-12-00134.1)

## Reports and Books

- Anderson, D.M., 2013: Paleooceanography, records: Late Pleistocene North Atlantic. In: *Encyclopedia of Quaternary Science*, 2<sup>nd</sup> ed. [S.A. Elias and C.J. Mock, (Eds.)] Elsevier, Edinburgh, pp. 9–17.
- Anderson, D.M., and K.E. Lee, 2013: Paleooceanography: An overview. In: *Encyclopedia of Quaternary Science*, 2<sup>nd</sup> ed. [S.A. Elias and C.J. Mock, (Eds.)] Elsevier, Edinburgh, pp. 754–754.
- Blunden, J., and D.S. Arndt, (Eds.), 2013: State of the climate in 2012. *Bulletin of the American Meteorological Society*, **94** (8), S1–S239, [doi:10.1175/2013BAMSStateoftheClimate.1](https://doi.org/10.1175/2013BAMSStateoftheClimate.1).
- Christensen, J.H., ..., J. Kossin, et al., 2013: Climate phenomena and their relevance for future regional climate change. In: *Climate Change 2013: The Physical Science Basis*. Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [T.F. Stocker et al. (Eds.)]. Cambridge University Press, in press. Draft available online at <http://www.ipcc.ch/report/ar5/wg1/>.
- Ellin, R., ..., and K. Shein, 2013: North Carolina Sentinel Site Cooperative: Report on the Sea-Level Rise Research and Monitoring Coordination Workshop. NOAA Technical Memorandum NMFS-SEFSC-650. 56 pp. Online at [http://oceanservice.noaa.gov/sentinelsites/pdf/NC\\_SSC\\_SLR\\_Research\\_Coordination\\_Wkshop.pdf](http://oceanservice.noaa.gov/sentinelsites/pdf/NC_SSC_SLR_Research_Coordination_Wkshop.pdf).
- Konrad, C.E., and C.M. Fuhrmann, 2013: Climate of the southeast United States: Past, present and future. In: *Climate of the Southeast United States: Variability, Change, Impacts, and Vulnerability* [Ingram, K.T., K. Dow, and L. Carter (Eds.)]. Island Press, pp. 8–42.
- Peterson, T.C., M.P. Hoerling, P.A. Stott, and S.C. Herring, (Eds.), 2013: Explaining extreme events of 2012 from a climate perspective. *Bulletin of the American Meteorological Society*, **94** (9), S1–S74, [doi:10.1175/BAMS-D-13-00085.1](https://doi.org/10.1175/BAMS-D-13-00085.1).
- Regional climate trends and scenarios for the U.S. National Climate Assessment. NOAA, National Environmental Satellite, Data, and Information Service. 9 volumes. [http://www.nesdis.noaa.gov/technical\\_reports/142\\_Climate\\_Scenarios.html](http://www.nesdis.noaa.gov/technical_reports/142_Climate_Scenarios.html)
- Shein, K., and T. Owen, 2013: Coastal Wind and Water Event Database (CWWED) in support of the Consumer Option for an Alternative System to Allocate Losses Act of 2012 (COASTAL Act of 2012). Whitepaper for NOAA, 24 pp.
- Williams, S.J., ..., J.P. Kossin, M. Lilly, J.J. Marra, et al., 2013: Physical climate forces. In: *Coastal Impacts, Adaptation and Vulnerability: A Technical Input to the 2013 National Climate Assessment*. [V.R. Burkett and M.A. Davidson, (Eds.)] Island Press, pp. 10–51. Online at [http://downloads.usgcrp.gov/NCA/technicalinputreports/Burkett\\_Davidson\\_Coasts\\_Final\\_.pdf](http://downloads.usgcrp.gov/NCA/technicalinputreports/Burkett_Davidson_Coasts_Final_.pdf)

Zhao, X.-P., J. Privette, M. Goldberg, and S. Walters, 2013: Maintaining the continuation of long-term satellite total solar irradiance observation. *NOAA/NESDIS Report for the review of NRC of National Academy of Science*, 35 pp.

Zwiers, F.W., L.V. Alexander, G.C. Hegerl, T.R. Knutson, J.P. Kossin, et al., 2013: Challenges in estimating and understanding recent changes in the frequency and intensity of extreme climate and weather events. In: *Climate Science for Serving Society: Research, Modeling and Prediction Priorities*. [G.R. Asrar and J.W. Hurrell, (Eds.)] Springer, Netherlands, pp. 339–389.

## Conferences

First Symposium on Building a Weather-Ready Nation: Enhancing Our Nation’s Readiness, Responsiveness, and Resilience to High Impact Weather Events, Austin, Texas, 5-10 January 2013

Santos, P., D. Sharp, A. Devanas, J.G. Estupiñán, M.J. Moreland, D.P. Brown, and J. Rhome: NWS emergency response specialist short course: Responding to tropical cyclone emergencies. <https://ams.confex.com/ams/93Annual/webprogram/Paper215986.html>

Third Conference on Transition of Research to Operations, Austin, Texas, 5-10 January 2013

Bates, J.J., W. J. Glance, and J. Privette: Lessons on research to operations from NOAA’s Climate Data Record Program. <https://ams.confex.com/ams/93Annual/webprogram/Paper220324.html>

Ferraro, R.R., S.A. Boukabara, R.J. Kuligowski, F. Weng, P.Ya. Groisman, P. Xie, and C.R. Williams: NOAA’s risk reduction activities in preparation for the Global Precipitation Measurement (GPM) Mission. <https://ams.confex.com/ams/93Annual/webprogram/Paper216736.html>

Third International Workshop on Climate Informatics, Boulder, Colo., 26-27 September 2013

- Wahl, E., H. Diaz, and J. Smerdon: Temperature response to large tropical volcanic eruptions in Western North America: Relationship to ENSO phases.

Third Symposium on Advances in Modeling and Analysis Using Python, Austin, Texas, 5-10 January 2013

Dobson, J.G., J.D. Morgan, K.E. Kunkel, and L.E. Stevens: The use of GIS and Python scripting for processing and mapping national and regional climate data simulations [Invited]. <https://ams.confex.com/ams/93Annual/webprogram/Paper224088.html>

Rutledge, G.K., D. Williams, and J.J. Hnilo: Computational data analysis in the era of peta-scale digital archives: Advancing web services to reduce data access latencies. <https://ams.confex.com/ams/93Annual/webprogram/Paper224473.html>

Third Workshop on Medium/Long Range Weather Forecasting and Subseasonal Atmospheric Drivers, Albany, NY, 15 May 2013

- Schreck, C.J: Scale interactions: Bridging the gap between the tropics and extratropics.

Fourth WGENE Workshop on Systematic Error in Weather and Climate Models, Exeter, UK, 15-19 April 2013

- Zhang, H.-M., G. Peng, L. Vasquez, W. Hankins, C.W. Fairall, R. Weller, and A. Brown, 2013: The SURFA Project: Towards near-real-time quality monitoring of NWP forecasts and historical analysis.

Fifth Symposium on Aerosol-Cloud-Climate Interactions, Austin, Texas, 5-10 January 2013

Inamdar, A.K., and K. Knapp: Detection of aerosol signal from geostationary satellite visible imagery. <https://ams.confex.com/ams/93Annual/webprogram/Paper216088.html>

Sixth Conference on the Meteorological Applications of Lightning Data, Austin, Texas, 5-10 January 2013

Ansari, S., J.N. Lott, and S.A. Del Greco: Lightning products and services at NOAA’s National Climatic Data Center. <https://ams.confex.com/ams/93Annual/webprogram/Paper220826.html>



Eighth Symposium on Policy and Socio-economic Research, Austin, Texas, 5-10 January 2013

Shafer, M.A., D.P. Brown, and C. McNutt: Managing the 2011 drought: A climate services partnership. <https://ams.confex.com/ams/93Annual/webprogram/Paper219151.html>

Ninth Annual Symposium on Future Operational Environmental Satellite Systems, Austin, Texas, 5-10 January 2013

Biard, J., L. Copley, D. Baldwin, D. Saunders, and J. Privette: The VIIRS climate raw data record: An easy-to-use raw data set (Level 1b) for the Suomi-NPP Visible Infrared Imaging Radiometer Suite. <https://ams.confex.com/ams/93Annual/webprogram/Paper223957.html>

Carter, D., J.S. Morris, and N.A. Ritchey: New developments in NOAA's Comprehensive Large Array-Data Stewardship System. <https://ams.confex.com/ams/93Annual/webprogram/Paper219133.html>

Csiszar, I.A., J.L. Privette, C.O. Justice, M. Román, and E. Vermote: Development and evaluation of the terrestrial environmental data products from the Suomi NPP satellite. <https://ams.confex.com/ams/93Annual/webprogram/Paper223885.html>

Guillevic, P.C., and J.L. Privette: NPP VIIRS land surface temperature EDR validation using NOAA's observation networks. <https://ams.confex.com/ams/93Annual/webprogram/Paper219549.html>

Peng, G., M.J. Denning, D. Saunders, M. Iwunze, R. Ullman, and J.L. Privette: A low-cost and efficient way to archive calibration/validation findings for satellite data. <https://ams.confex.com/ams/93Annual/webprogram/Paper220184.html>

Privette, J.L., W.J. Gance, D. Cecil, and J.J. Bates: Supporting private sector decision-making with NOAA's Interim Climate Data Records (ICDRs). <https://ams.confex.com/ams/93Annual/webprogram/Paper220808.html>

Privette, J.L., S. Walters, G. Kopp, J. Lean, and R.F. Cahalan: Mitigating a likely gap in total solar irradiance measurements between the SORCE and TSIS missions. <https://ams.confex.com/ams/93Annual/webprogram/Paper220811.html>

Tanner, M.: Societal benefits of the environmental satellites. <https://ams.confex.com/ams/93Annual/webprogram/Paper224236.html>

12th Annual Energy Conference for Traders and Analysts, Las Vegas, Nevada, 17 October 2013

- Schreck, C.J.: The latest on the MJO. [MDA Weather Services' Remote Presentation]

12th Annual Student Conference, Austin, Texas, 5-10 January 2013

Fetanat, G., A. Homaifar, and K. Knapp: Tropical cyclone intensity estimation from satellite images. <https://ams.confex.com/ams/93Annual/webprogram/Paper224507.html>

Gilford, D., M.L. Griffin, S.R. Smith, and A. Arguez: Characteristics of ENSO-associated southeast US daily temperature range frequencies. <https://ams.confex.com/ams/93Annual/webprogram/Paper224474.html>

17th Conference on Integrated Observing and Assimilation Systems for the Atmosphere, Oceans, and Land Surface (IOAS-AOLS), Austin, Texas, 5-10 January 2013

Young, A., and J.J. Bates: Application of cloud vertical structure to investigate the microphysical and optical properties of cirriform, anvil, and deep convective clouds. <https://ams.confex.com/ams/93Annual/webprogram/Paper220807.html>

19th AMS Satellite Meteorology, Oceanography and Climatology Conference and 2013 EUMETSAT Meteorological Satellite Conference, Vienna, Austria, 16-20 September

- Schroeder, M., A. Gambacorta, L. Shi, M. Lockhoff, A. Walther, R. Bennartz, F. Fell, and J. Schulz: The GEWEX Water Vapour Assessment (G-VAP).
- Tanner, M.: Societal benefits of the environmental satellites.
- Yu, Y., I. Csiszar, S. Liang, Y. Liu, D. Wang, P. Yu, Y. Tang, J. Privette, P. Guillevic, C. Schaaf, and Z. Wang: JPSS S-NPP land surface products: Status of land surface temperature and albedo EDRs.

20th Conference on Applied Climatology, Austin, Texas, 5-10 January 2013

Arguez, A.: NOAA's 1981-2010 agricultural normals: Frost-freeze probabilities, Growing season length, and growing degree days. <https://ams.confex.com/ams/93Annual/webprogram/Paper220496.html>

Bell, J.E., and J.L. Matthews: Comparison of USCRN temperature measurements to remotely-sensed phenology. <https://ams.confex.com/ams/93Annual/webprogram/Paper218421.html>

Bilotta, R.G., E. Shepherd, and J.E. Bell: Comparison of frost depth penetration based on an updated air-freezing index and on USCRN soil temperatures. <https://ams.confex.com/ams/93Annual/webprogram/Paper219630.html>

Boone, M., M.A. Shafer, C. McNutt, D.P. Brown, and M.J. Hayes: Managing drought in the southern plains: Discussing impacts to promote planning. <https://ams.confex.com/ams/93Annual/webprogram/Paper220642.html>

Cooper, J.: Data management at the other end of the data life cycle. <https://ams.confex.com/ams/93Annual/webprogram/Paper220831.html>

Leeper, R.D., and J. Rennie: Impact of network design on daily temperature and precipitation and their application: USCRN and COOP. <https://ams.confex.com/ams/93Annual/webprogram/Paper218322.html>

Lott, J.N.: NOAA's Climate.gov and National Climatic Data Center websites—New versions released in 2012. <https://ams.confex.com/ams/93Annual/webprogram/Paper220413.html>

Palecki, M.: U.S. Climate Reference Network (USCRN): Applications of high temporal resolution fan-aspirated temperature observations. <https://ams.confex.com/ams/93Annual/webprogram/Paper220392.html>

Rennie, J., P. Thorne, J.H. Lawrimore, B. Gleason, M.J. Menne, and C.N. Williams Jr.: Development of the International Surface Temperature Initiative's global land surface databank. <https://ams.confex.com/ams/93Annual/webprogram/Paper218960.html>

Squires, M.F., J.H. Lawrimore, D.A. Robinson, M. Gerbush, and T. Estilow: Snowstorm dataset development. <https://ams.confex.com/ams/93Annual/webprogram/Paper220509.html>

Vincent, K., B. Phillips, and R. Lindsey: Communicating scientific climate papers and reports to the general public: How NOAA is using its arsenal of traditional, web-based and social media tools to successfully raise public awareness. <https://ams.confex.com/ams/93Annual/webprogram/Paper220451.html>

22nd Symposium on Education, Austin, Texas, 5-10 January 2013

Ansari, S., J.N. Lott, and S.A. Del Greco: The weather and climate toolkit. <https://ams.confex.com/ams/93Annual/webprogram/Paper220822.html>

Dissen, J., A. Arguez, T.G. Houston, and R.S. Voss: Climate normals and engagement with energy industry. <https://ams.confex.com/ams/93Annual/webprogram/Paper220404.html>

25th Conference on Climate Variability and Change, Austin, Texas, 5-10 January 2013

Arguez, A., and S. Applequist: A harmonic approach for calculating daily temperature normals constrained by homogenized monthly temperature normals. <https://ams.confex.com/ams/93Annual/webprogram/Paper220472.html>

Arndt, D.S.: State of the climate in 2012. <https://ams.confex.com/ams/93Annual/webprogram/Paper220832.html>

Bilotta, R.G., E. Shepherd, and J.E. Bell: Changes in air-freezing index and frost depth between two climate normals periods. <https://ams.confex.com/ams/93Annual/webprogram/Paper219839.html>

Bornstein, R., A.T. Ghebregziabhe, M.J. Menne, and J. Gonzalez: Case study on the impact of homogenizing monthly temperature series along coastal California. <https://ams.confex.com/ams/93Annual/webprogram/Paper223492.html>



Durre, I., M.G. Donat, L.V. Alexander, and H. Yang: GHCNDEX: Global land-based datasets for monitoring climatic extremes. <https://ams.confex.com/ams/93Annual/webprogram/Paper220343.html>

Easterling, D.R., K.E. Kunkel, and X. Yin: Observed increases in probable maximum precipitation over global land areas.

<https://ams.confex.com/ams/93Annual/webprogram/Paper220332.html>

Knapp, K., C.C. Hennon, C.J. Schreck III, and S.E. Stevens: Citizen scientists and tropical cyclone activity. <https://ams.confex.com/ams/93Annual/webprogram/Paper220555.html>

Kruk, M.C., and J. Marra: A regional intercomparison of rainfall and wind speed extremes. <https://ams.confex.com/ams/93Annual/webprogram/Paper220315.html>

Kunkel, K.E.: Assessing changes in extreme weather and climate events [Invited]. <https://ams.confex.com/ams/93Annual/webprogram/Paper212788.html>

Kunkel, K.E., L.E. Stevens, and J.G. Dobson: Uncertainties in regional simulations of the U.S. climate in the 20th and 21st Centuries. <https://ams.confex.com/ams/93Annual/webprogram/Paper218204.html>

Lawrimore, J., M. Squires, K.E. Kunkel, and D.A. Robinson: The changing nature of severe snowstorms in the U.S. <https://ams.confex.com/ams/93Annual/webprogram/Paper220503.html>

Peterson, T.C., R. Heim, T.R. Karl, R.S. Vose, ..., K.E. Kunkel, et al.: Monitoring and understanding changes in heat waves, cold waves, floods and droughts in the United States: State of knowledge. <https://ams.confex.com/ams/93Annual/webprogram/Paper220221.html>

Squires, M.F., T.R. Karl, and R.W. Katz: Monitoring changes in U.S. weather and climate extremes. <https://ams.confex.com/ams/93Annual/webprogram/Paper220539.html>

Vose, R.S.: Monitoring and understanding changes in extremes: Extratropical storms, winds, and waves. <https://ams.confex.com/ams/93Annual/webprogram/Paper220830.html>

Wuebbles, D.J., J.E. Walsh, K. Hayhoe, K.E. Kunkel, G. Stephens, P. Thorne, R.S. Vose, M.F. Wehner, and J. Willis: The U.S. National Climate Assessment: The science of climate change [Invited]. <https://ams.confex.com/ams/93Annual/webprogram/Paper214976.html>

27th Conference on Hydrology, Austin, Texas, 5-10 January 2013

Brewer, M.J., and R. Heim: The global drought information system—A decision support tool with global applications. <https://ams.confex.com/ams/93Annual/webprogram/Paper220829.html>

Leeper, R.D., O.P. Prat, and B. Blanton: Understanding the hydrological affects of tropical cyclones over the Carolinas from an observational and modeling based perspective. <https://ams.confex.com/ams/93Annual/webprogram/Paper218479.html>

Rickenbach, T.M., R. Nieto-Ferreira, S.E. Stevens, B.R. Nelson, and B. Blanton: Building a climatology of precipitation system organization in the Carolinas using the NOAA radar-based Multi-Sensor Precipitation Estimation (MPE) product. <https://ams.confex.com/ams/93Annual/webprogram/Paper220481.html>

29th Conference on Environmental Information Processing Technologies (formerly IIPS), Austin, Texas, 5-10 January 2013

Crum, T., M.J. Istok, C. Horvat, D.J. Horvat, and S. Del Greco: A 2013 update on access to real time and archive NOAA weather radar data. <https://ams.confex.com/ams/93Annual/webprogram/Paper221598.html>

38th Climate Diagnostic and Prediction Workshop, College Park, Maryland, 21-24 October 2013

- Bates, J.J.: Climate monitoring from space [Invited].

American Academy for the Advancement of Sciences (AAAS), Washington, D.C., 15 February 2013

- Karl, T.R.: The weather and climate challenge of food security: Extreme events in the United States [Invited].

American Geophysical Union Fall Meeting, San Francisco, Calif., 9-13 December 2013

- Bates, J.J., M. Dowell, P. Lecomte, and J. Schulz: Climate monitoring from space – Architecture for sustained observations.
- Daloz, A.S., S.J. Camargo, J.P. Kossin, and K. Emanuel: Cluster analysis of explicitly and downscaled simulated North Atlantic tropical cyclone tracks.
- Hennon, C.C., K.R. Knapp, C.J. Schreck, S.E. Stevens, and J.P. Kossin: Cyclone center: Using crowdsourcing to determine tropical cyclone intensity [Invited].
- Morrill, C., E. Ward, A.J. Wagner, B.L. Otto-Bliesner, and N.A. Rosenbloom: Large sensitivity to freshwater forcing location in 8.2 ka simulations.
- Morrill, C., and Y. Li: Drivers of Asian winter monsoon evolution since the Last Glacial Maximum [Invited].
- Rennie, J., P. Thorne, J.H. Lawrimore, B. Gleason, M.J. Menne, and C. Williams: An open and transparent databank of global land surface temperature.
- Wagner, A.J., J. Zivkovic, D. Anderson, and N.E. Umling: Combining geochemical proxies in Porites coral cores from Chuuk Lagoon, Micronesia.
- Wahl, E.R., H.F. Diaz, and J.E. Smerdon: Winter temperature response to large tropical volcanic eruptions in temperate Western North America: Relationship to ENSO phases.

ESA Living Planet Symposium 2013, Edinburgh, Scotland, 9-13 September 2013

- Bates, J.: Metrics for assessing the completeness of climate data records.

International Geoscience and Remote Sensing Symposium (IGARSS), Melbourne, Australia, 21-26 July 2013

- Guillevic, P.C., J.L. Privette, et al., 2013: NPP VIIRS land surface temperature product validation using worldwide observation networks.
- Olioso, A., M. Mira, D. Courault, O. Marloie, and P. Guillevic, 2013: Impact of surface emissivity and atmospheric conditions on surface temperatures estimated from top of canopy brightness temperatures derived from Landsat 7 data.
- Peng, G., and W. Meier: Characterization of a satellite-based passive microwave sea ice concentration climate data record.

2013 Joint Mathematics Meeting (American Mathematics Society), San Diego, Calif., 9-12 January 2013

- Wahl, E.R.: Advances and opportunities for mathematical treatment of paleoclimate reconstructions.

MJO Field Data and Science Workshop, Kohala Coast, Hawaii, 4-8 March 2013

- Schreck, C.J.: Comparing MJO diagnostics during DYNAMO.

NOAA Satellite Conference for Direct Readout, GOES/POES, and GOES-R/JPSS Users, College Park, MD, 11 April 2013

- Schreck, C.J.: Use of NOAA satellite products by the energy sector.

NOAA Workshop on Data Visualization to Support Ecosystem Based Management, Portland, Maine, 6 February 2013

- Shein, K., 2013: IMPACT: A climate data and visualization tool for marine protected areas.

PAGES 4th Open Science Meeting, Goa, India, 13-16 February 2013

- Anderson, D., E. Wahl, A. Shah, B. Bauer, C. Buckner, E. Gille, and C. Morrill: An expanded archive facilitating temperature reconstructions of the past two millennia from paleo proxies.

Statistical and Applied Mathematical Sciences Institute Undergraduate Modeling Workshop, Raleigh, NC, 13 May 2013

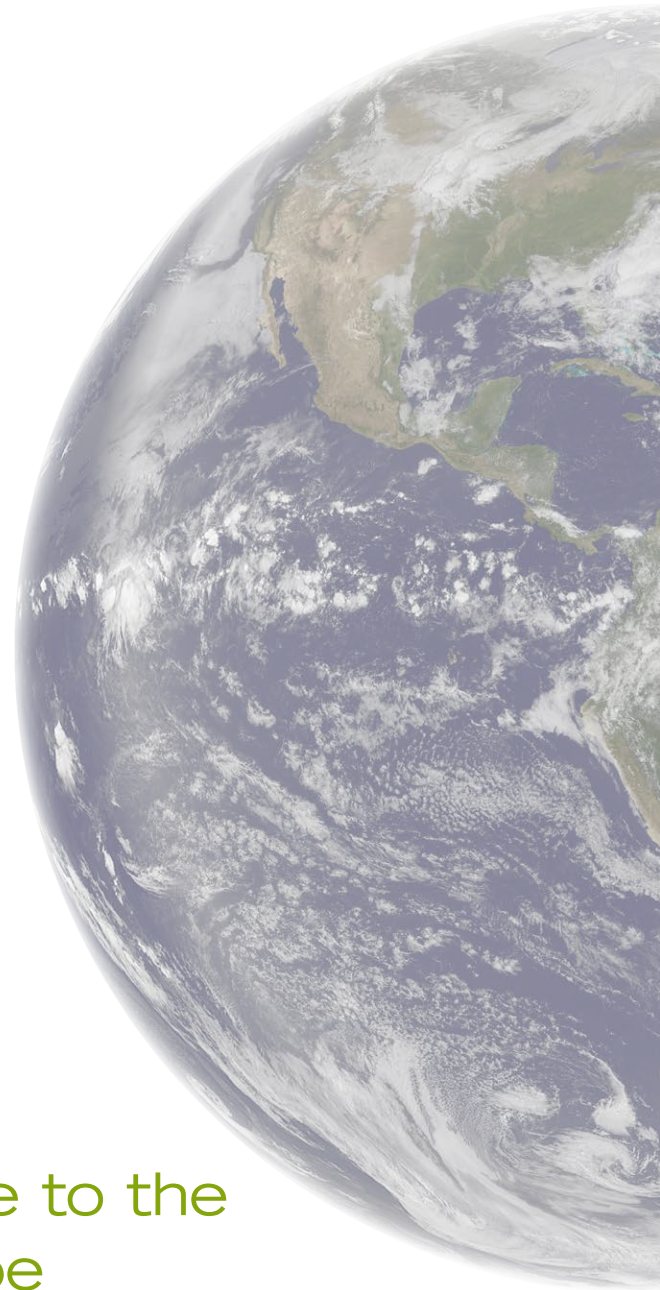
- Schreck, C.J.: Overview of hurricanes and seasonal hurricane prediction.

U.S. CLIVAR Workshop: Analyses, Dynamics, and Modeling of Large Scale Meteorological Patterns Associated with Extreme Temperature and Precipitation Events, Berkeley, Calif., 20-22 August 2013

- Groisman, P.: The impact of data paucity and handling techniques on intense precipitation analyses.
- Kunkel, K.: Meteorological causes of observed extreme precipitation trends in the U.S.



NOAA's National Climatic Data Center maintains the world's largest climate data archive and provides climatological services and data to every sector of the United States economy and to users worldwide.



Data spans from the Stone Age to the Space Age and across the globe





# GOES-R

*Geostationary Operational Environmental Satellite - R Series*



***The next-generation of geostationary environmental satellites***



**Advanced imaging  
for accurate forecasts**



**Real-time mapping  
of lightning activity**



**Improved monitoring  
of solar activity**

Spacecraft image courtesy of Lockheed Martin



# CREDITS

Editors: Susan Osborne and Katy Vincent  
Layout and artistic design: Deborah Riddle  
Technical support: Sara Veasey  
Bibliography: Mara Sprain

NOAA's National Climatic Data Center  
151 Patton Avenue  
Asheville, North Carolina 28801  
[ncdc.noaa.gov](http://ncdc.noaa.gov)

A SPECIAL THANK YOU TO:  
NCDC Staff for their input and review  
NCDC Graphics Team



@NOAANCDC





